

Alpha Magnetic Spectrometer - 02 (AMS-02) Experiment / Payload Integration Hardware (PIH) Interfaces

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ALPHA MAGNETIC SPECTROMETER – 02 (AMS-02) EXPERIMENT/PAYLOAD INTEGRATION HARDWARE (PIH) INTERFACES

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PREFACE

This Interface Control Document (ICD) represents the interface agreement between the Alpha Magnetic Spectrometer – 02 (AMS-02) Experiment and the Payload Integration Hardware (PIH) for the version of the payload to be operated on the International Space Station (ISS) for approximately three (3) years beginning with installation on the ISS during Utilization Flight 4 (UF4), presently designated as ISS-26-UF4 and shuttle flight STS-130. The mission baseline is 1000 days of operational time (24,000 hours) in full deep space view.

A precursor flight (AMS-01) was accomplished on the Space Shuttle during the STS-91 flight and was addressed in an ICD similar to this document. The AMS on STS-91 was operated for approximately 8.5 days during the flight.

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ACRONYMS AND ABBREVIATIONS

AMP	AMPERE
AMS	ALPHA MAGNETIC SPECTROMETER
APCU	ASSEMBLY POWER CONVERTER UNIT
APS	AUTOMATED PAYLOAD SWITCH
BC	BUS CONTROLLER
BFS	BACK-UP FLIGHT SYSTEM
CCP	CONFIGURATION CONTROL PANEL
CD&H	COMMAND AND DATA HANDLING
CDR	CRITICAL DESIGN REVIEW
CIR	CARGO INTEGRATION REVIEW
CMD	COMMAND
CMP	CONFIGURATION MANAGEMENT PLAN
COFR	CERTIFICATE OF FLIGHT READINESS
CR/DIR	CHANGE REQUEST/DIRECTIVE
CSR	CUSTOMER SUPPORT ROOM
dB	DECIBEL
DCU	DATA CONVERSION UNIT
DDRS	DIGITAL DATA RECORDER SYSTEM
DOE	DEPARTMENT OF ENERGY
DOL	LOW LEVEL DISCRETE OUTPUT
EMC	ELECTROMAGNETIC COMPATIBILITY
EMI	ELECTROMAGNETIC INTERFERENCE
EVA	EXTRAVEHICULAR ACTIVITY
FOR	FLIGHT OPERATIONS REVIEW
FPSR	FLIGHT PLANNING AND STOWAGE REVIEW
FRGF	FLIGHT RELEASABLE GRAPPLE FIXTURE
FRR	FLIGHT READINESS REVIEW
GFE	GOVERNMENT FURNISHED EQUIPMENT
GHE	GROUND HANDLING EQUIPMENT
GND	GROUND
GPC	GENERAL PURPOSE COMPUTER
GSE	GROUND SUPPORT EQUIPMENT
HW	HARDWARE
HRDL	HIGH RATE DATA LINK

ACRONYMS AND ABBREVIATIONS (CONTINUED)

HZ	HERTZ
ICD	INTERFACE CONTROL DOCUMENT
IDD	INTERFACE DESIGN DOCUMENT
IDRD	INCREMENT DEFINITION AND REQUIREMENTS DOCUMENT
IFP	INTERFACE PANEL
IPT	INTEGRATED PRODUCT TEAM
ISS	INTERNATIONAL SPACE STATION
ISSP	INTERNATIONAL SPACE STATION PROGRAM
JIS	JOINT INTEGRATED SIMULATIONS
JISWG	JOINT INTEGRATED SIMULATIONS WORKING GROUP
JOIP	JOINT OPERATIONS INTERFACE PROCEDURES
JSC	LYNDON B. JOHNSON SPACE CENTER
KSC	JOHN F. KENNEDY SPACE CENTER
LEPS	LOW ENERGY PARTICLE SHIELD
LMSO	LOCKHEED MARTIN SPACE OPERATIONS
MAPTIS	MATERIALS AND PROCESSES TECHNOLOGY INFORMATION SYSTEM
MCC	MISSION CONTROL CENTER
MDL	MASTER DOCUMENT LIST
MDM	MULTIPLEXER/DEMULTIPLEXER
MIL-STD	MILITARY STANDARD
MIP	MISSION INTEGRATION PLAN
MIT	MASSACHUSETTS INSTITUTE OF TECHNOLOGY
MS	MILLISECOND
PIB	MISSION MANAGEMENT OFFICE
MUA	MATERIAL USAGE AGREEMENTS
NASA	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NBL	NEUTRAL BUOYANCY LABORATORY
NHB	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HANDBOOK
NSTS	NATIONAL SPACE TRANSPORTATION SYSTEM
OIU	ORBITER INTERFACE UNIT

ACRONYMS AND ABBREVIATIONS (CONTINUED)

OMRSD	OPERATIONS AND MAINTENANCE REQUIREMENTS AND SPECIFICATIONS DOCUMENT
PAS	PAYOUT ATTACH SYSTEM
PCU	POWER CONVERSION UNIT
PDA	PAYOUT DISCONNECT ASSEMBLY
PDD	POWER AND DATA LINE DISTRIBUTOR BOX
PDIP	PAYOUT DISTRIBUTION INTERFACE PANEL
PDR	PRELIMINARY DESIGN REVIEW
PEDS	PASSIVE ELECTRICAL DISCONNECT SYSTEM
PFR	PORTABLE FOOT RESTRAINT
PIB	JSC PLANNING AND INTEGRATION BRANCH (SF3)
PIH	PAYOUT INTEGRATION HARDWARE
P/L	PAYOUT
PMP	PROJECT MANAGEMENT PLAN
P/N	PART NUMBER
POCC	PAYOUT OPERATIONS CONTROL CENTER
POIC	PAYOUT OPERATIONS INTEGRATION CENTER
POWG	PAYOUT OPERATIONS WORKING GROUP
PRD	PROGRAM REQUIREMENTS DOCUMENT
PSRP	PAYOUT SAFETY REVIEW PANEL
PVGF	POWER VIDEO GRAPPLE FIXTURE
PWR	POWER
RCV	RECEIVE
ROEU	REMOTELY OPERATED ELECTRICAL UMBILICAL
RT	REMOTE TERMINAL
RTN	RETURN
SCL	SPACE CRYOMAGNETICS LTD.
SDOS	SCIENCE DATA AND OPERATIONS EQUIPMENT
SFHe	SUPERFLUID HELIUM
SIG	SIGNAL
SRMS	SHUTTLE REMOTE MANIPULATOR SYSTEM
SSP	SPACE STATION PROGRAM / STANDARD SWITCH PANEL
SSRMS	SPACE STATION REMOTE MANIPULATOR SYSTEM

ACRONYMS AND ABBREVIATIONS (CONTINUED)

STA	STRUCTURAL TEST ARTICLE
STE	SPECIAL TEST EQUIPMENT
STS	SPACE TRANSPORTATION SYSTEM
TBD	TO BE DETERMINED
TBDL	TO BE DETERMINED BY LOCKHEED MARTIN
TBDA	TO BE DETERMINED BY AMS PAYLOAD
TIM	TECHNICAL INTERCHANGE MEETINGS
UMA	UMBILICAL MECHANISM ASSEMBLY
USS	UNIQUE SUPPORT STRUCTURE
VAC	VOLTAGE, ALTERNATING CURRENT
VAR	VERIFICATION ACCEPTANCE REVIEW
VC	VACUUM CASE
VDC	VOLTAGE, DIRECT CURRENT
WAD	WORK AUTHORIZATION DOCUMENT
XMT	TRANSMIT

1.0 INTRODUCTION

1.1 GENERAL

In this Interface Control Document (ICD) “AMS” will refer to the total complement of activities, hardware, software, test, integration and operation of the Alpha Magnetic Spectrometer – 02 (AMS-02). The flight hardware is referred to as the “AMS Payload” and is comprised of two parts: the “AMS Experiment” provided by the international AMS Experiment Collaboration and the “AMS Payload Integration Hardware (PIH)” provided by the JSC Planning and Integration Branch (PIB) of the Flight Projects Division with the support of Lockheed Martin Space Operations (LMSO).

This ICD pertains only to the version of the AMS (AMS-02) that will be installed and operated on the International Space Station (ISS). The acronym “AMS-01” will be used for references to the precursor flight version that flew on STS-91.

This ICD will be issued in two Parts. Part 1 will be the “Management” document and Part 2 will be the “Technical” document. This is the Technical document and will be referred to herein as “this document” or “Part 2 of this ICD.”

1.2 AMS PAYLOAD DESCRIPTION

The AMS Experiment is a state-of-the-art particle physics detector containing a large, cryogenic superfluid helium superconducting magnet that will be designed, constructed, tested and operated by an international team organized under United States Department of Energy (DOE) sponsorship. The AMS Experiment will use the unique environment of space to advance knowledge of the universe and potentially lead to a clearer understanding of the universe’s origin. Specifically, the science objectives of the AMS are to search for cosmic sources of antimatter (i.e., anti-helium or heavier elements) and dark matter.

1.3 DOCUMENT PURPOSE

This document defines and controls the design of electrical, mechanical, functional, Ground Support Equipment (GSE) and Ground Handling Equipment (GHE) interfaces between the AMS Experiment and the PIH.

1.4 SAFETY

To assure the safety of the AMS-02 Payload, the Orbiter and ISS vehicles, and personnel, the requirements of NSTS 1700.7B, "Safety Policy and Requirements for Payloads Using the Space Transportation System"; NSTS 1700.7B ISS Addendum, "Safety Policy and Requirements for Payloads Using the International Space Station"; 45 SW HB S-100/KHB 1700.7, "Space Shuttle Payload Ground Safety Handbook;" NSTS/ISS 18798, "Interpretations of NSTS/ISS Payload Safety Requirements;" and LMSMSS 31039, "Safety and Health Plan Science, Engineering, Analysis, and Test Contract" shall apply. Flight hazards shall be reviewed and approved by the Flight Payload Safety Review Panel and ground hazards by the KSC Ground Safety Panel in accordance with NSTS/ISS 13830, "Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and the International Space Station."

1.5 INTERFACE IDENTIFICATION

The interfaces identified in the following subsections shall be defined and controlled by this document.

1.5.1 ELECTRICAL

- a. Connectors – Pin Assignments
- b. Power Distribution from the Umbilical Mechanism Assembly (UMA)
- c. Avionics
 - (1) MIL-STD-1553 Data Bus Interface from Data Conversion Unit (DCU) to AMS-02 Experiment
 - (2) Fiber Optic Data Stream Interface from the DCU to AMS-02 Experiment
- d. Electromagnetic Compatibility (EMC)
- e. Grounding and Shielding

1.5.2 MECHANICAL

- a. Mechanical Interfaces between AMS-02 Experiment and PIH
- b. Physical Definition of AMS-02 Payload
 - (1) Weight
 - (2) Envelope
 - (3) Center of Gravity
 - (4) Experiment Package Mounting Footprint Outline
 - (5) Mounting Surface Finish and Flatness
 - (6) Alignment
 - (7) Field of View
- c. Limit Load Factors
- d. Emergency Limit Load Factors
- e. Safety Factors
- f. Fracture Control
- g. Temperature
 - (1) Surface Temperatures During Mission Phases
 - (2) Thermal Control, Active, Passive, Other

1.5.3 FUNCTIONAL

- a. Data Retrieval
- b. Servicing Operations
- c. AMS Payload Environments

2.0 DOCUMENTATION

The AMS-02 applicable and reference documents are listed in the Master Document List (MDL) in Program Requirements Document and Project Management Plan for the AMS PIH, JSC 27296 (Revision A). The current document issue in effect on the date of approval of this ICD shall apply unless otherwise noted. A notation of “Current issue” after date of approval indicates all future changes and revisions are applicable to the AMS project as stated above. Updates to the AMS Master Document List and their corresponding call-out in this and other AMS documents must be carefully considered as they may have significant impact to the hardware requirements, engineering, design, development, test, verification and operations. In the event of conflict between this ICD and any other documents invoked herein, the contents of this ICD shall govern.

3.0 ELECTRICAL REQUIREMENTS

This section addresses connectors and pin assignments, electrical power distribution, and the avionics interfaces, including the -MIL -STD-1553 bus for command and control status and the high rate fiber optics for scientific data. The electromagnetic compatibility requirements between the PIH and the AMS Experiment will also be defined in this section.

3.1 GENERAL

Electrical power, data stream and control signal interfaces between the PIH and the AMS Experiment shall be controlled at the interface connector panels:

- **Interface Panel A:** For the Orbiter services via the ROEU.
- **EVA Interface Panel:** For the ISS services via the UMA.

Systems electrical, command and data handling interfaces between the AMS Experiment and the PIH are defined in figure 3.1-1.

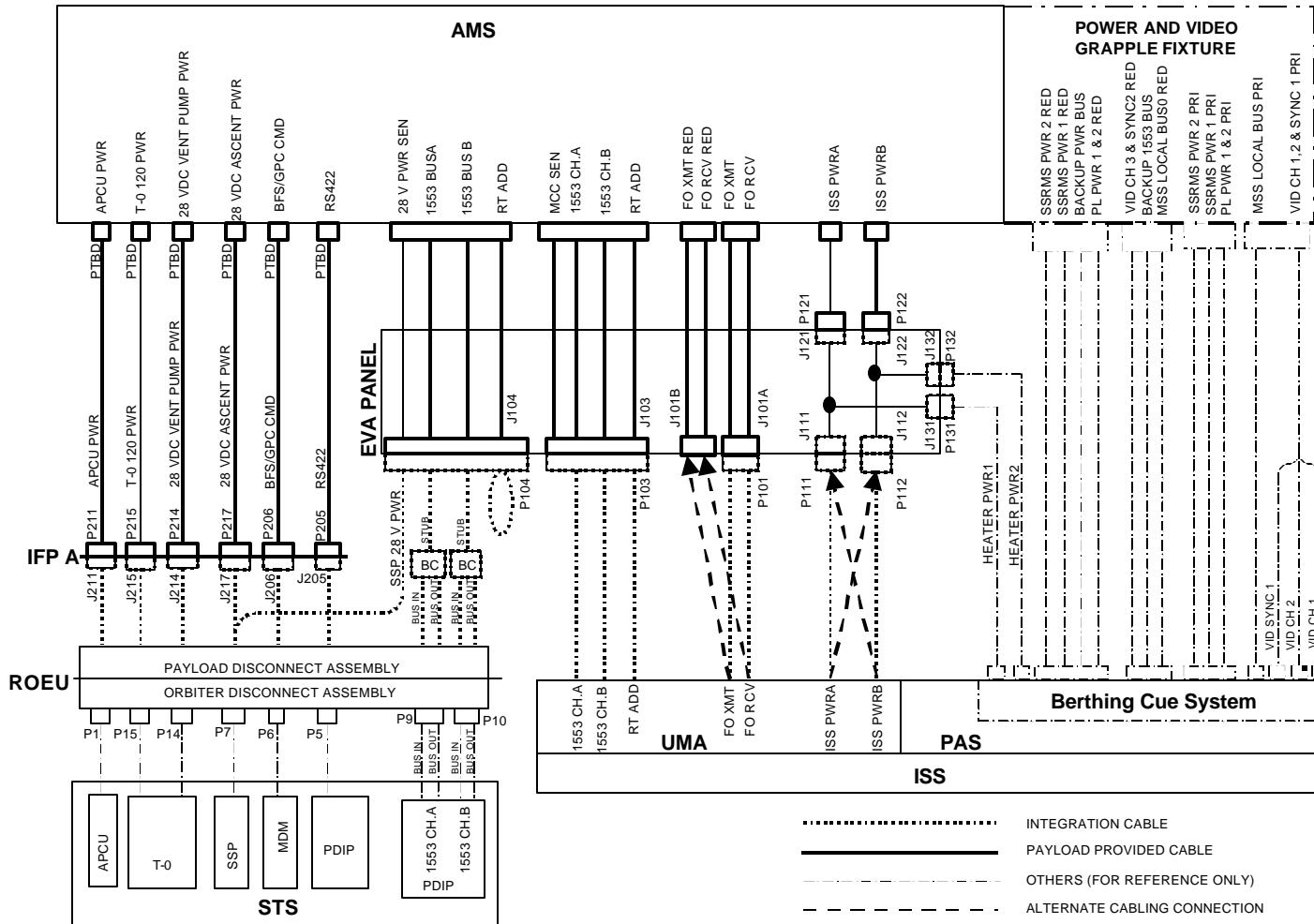


Figure 3.1-1 Systems Electrical, Command and Data Handling Interfaces

3.2 AMS-02 TO SHUTTLE INTERFACE

When the AMS-02 payload is installed on the Shuttle, the ROEU shall be utilized to provide the electrical, Command and Data Handling (CD&H) services between the Shuttle and the AMS-02 payload. The interface between the PIH and the AMS-02 payload shall be at the Interface Panel A.

3.2.1 Interface Panel A

The Interface Panel A shall be located on the upper Unique Support Structure (USS) next to the Payload Disconnect Assembly (PDA) as shown in Figure 3.2.1-1. The Interface Panel A shall contain 6 connectors; their function and designation shall be as listed in Table 3.2.1-2. The layout of the Interface Panel A shall be as shown in Figure 3.2.1-3.

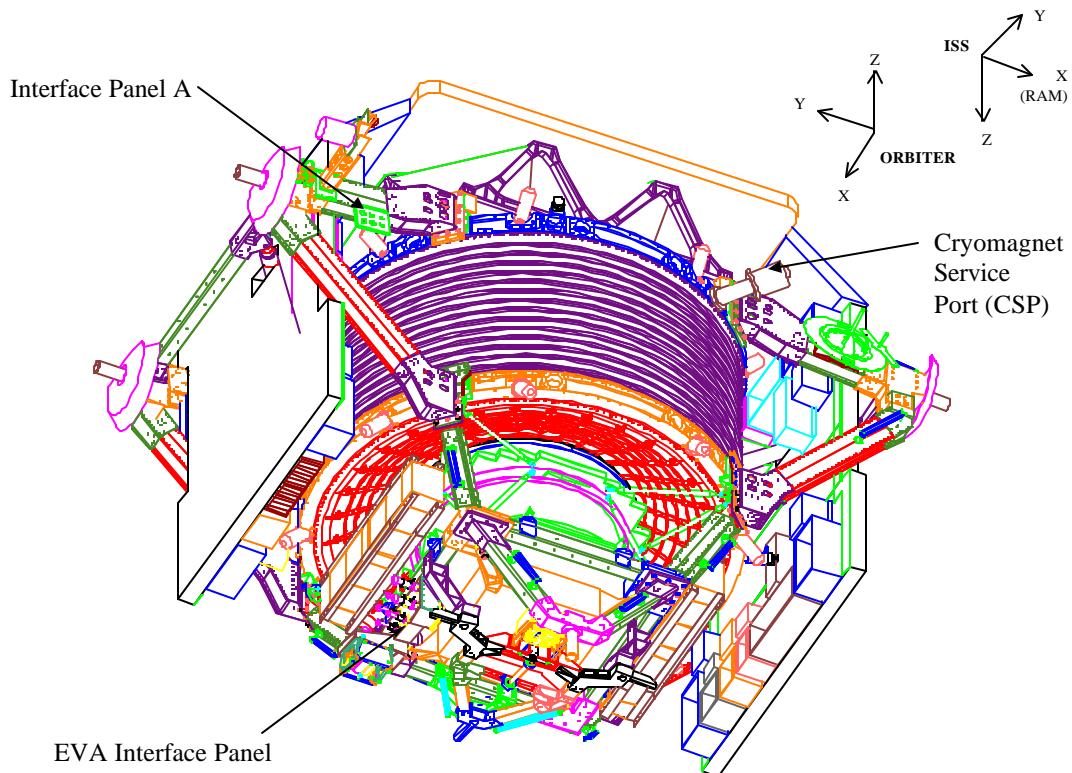


Figure 3.2.1-1 Interface Panel A Location (1 of 3)

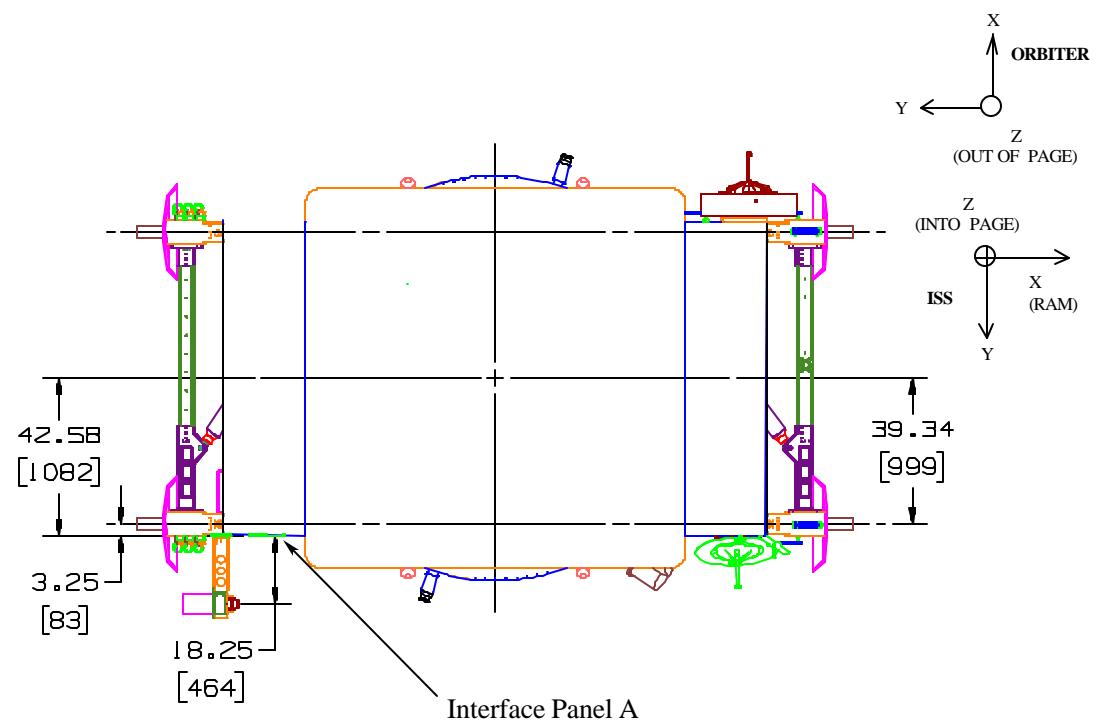


Figure 3.2.1-1 Interface Panel A Location (2 of 3)

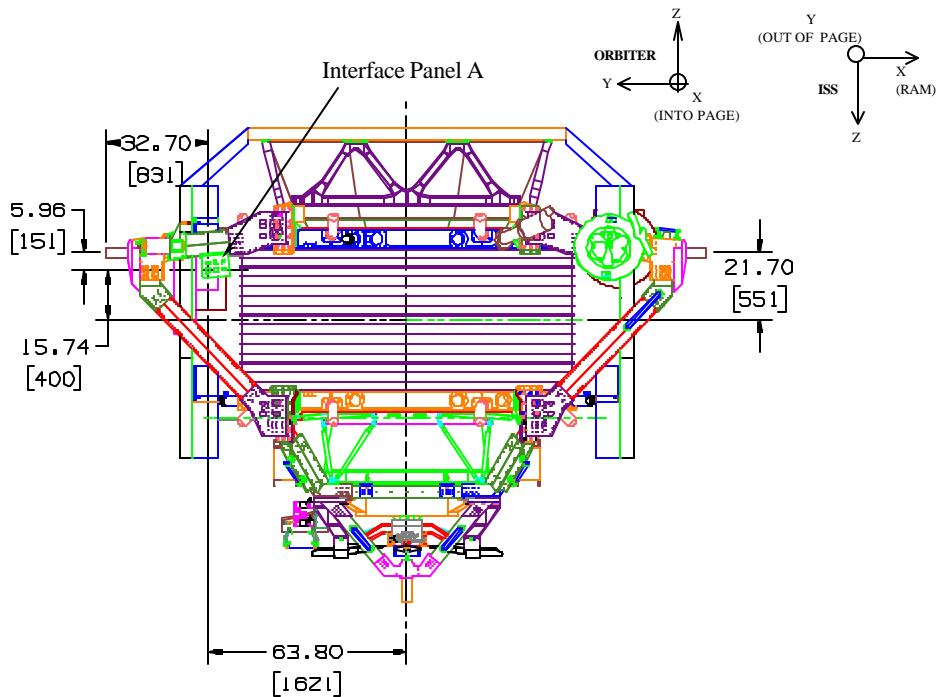


Figure 3.2.1-1 Interface Panel A Location (3 of 3)

REF DESIG.	FUNCTION
J205	RS422
J206	BFS/GPC CMD
J211	APCU PWR
J214	PUMP PWR
J215	T-0 PWR
J217	ASCENT PWR

TABLE 3.2.1-2 INTERFACE PANEL A CONNECTOR ASSIGNMENT

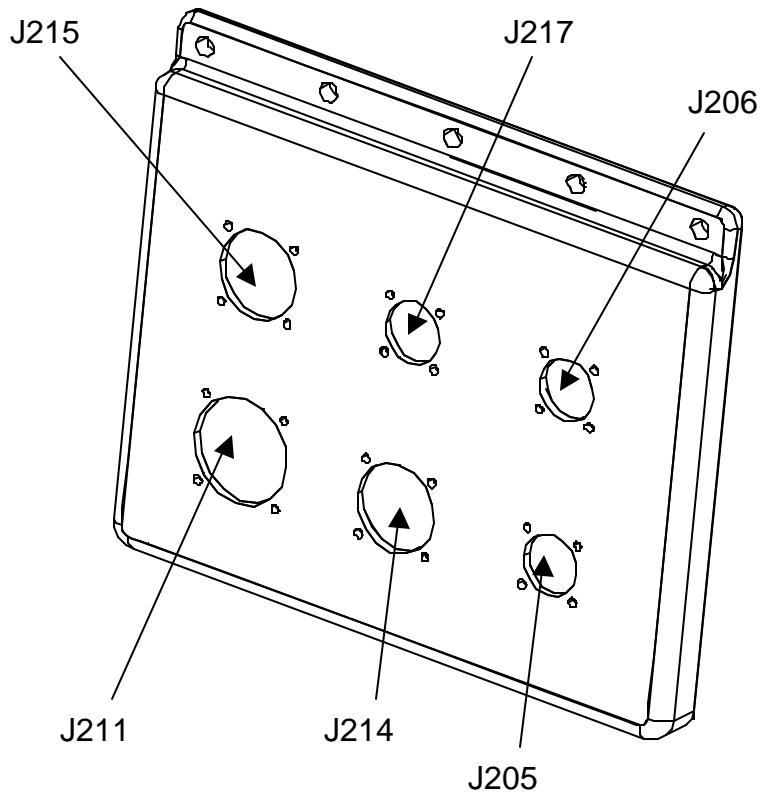


Figure 3.2.1-3 Interface Panel A Layout

3.2.1.1 Power

3.2.1.1.1 APCU 124 Vdc Power

AMS-02 receives 124 VDC power from the APCU in the Shuttle through connector J211 on the Interface panel A. The interface connector pin assignment shall be as shown in Table 3.2.1.1.1-1.

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J211

INTEG HW CONN ID:	J211
INTERFACE DESCRIPTION:	APCU PWR
INTEG HW CONN PART NO:	ME414-0234-7246 (ITT CANNON EQUIV P/N IS CVA0R2222S16)
INTEG HW CABLE PART NO:	*TBDL
P/L CONN ID:	P211

P/L CONN PART NO: ME414-0235-7247 (ITT CANNON EQUIV P/N IS CVA6R2222P16)
 P/L CABLE NO. *TBDA
 P/L CABLE DIA (IN): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
EO	PWR	2T1	8	A	APCU PWR 124VDC	APCU PWR 124VDC	
				B	NOT WIRED	NOT WIRED	
EO	RTN	2T1	8	C	APCU PWR RTN	APCU PWR RTN	
EO	GND	SC1	8	D	FAULT GND	FAULT GND	

GLOSSARY:

CABLE DESC: 2TX TWISTED PAIRS

CABLE DESC: SCX SINGLE CONDUCTOR

*TBBL TO BE DETERMINED BY LOCKHEED MARTIN

*TBDA TO BE DETERMINED BY AMS PAYLOAD

TABLE 3.2.1.1.1-1 APCU 124 VDC POWER PIN ASSIGNMENTS

3.2.1.1.1 APCU Output Electrical Power Definition

The APCU outputs electrical power to be utilized by other manifested ISS cargo elements, both in the Orbiter cargo bay and on the space station via the Orbiter Docking System docking mechanism electrical umbilical to the ISS. The output power characteristics are summarized in Figures 3.2.1.1.1.2-1 and 3.2.1.1.1.2-2. The 124 Vdc electrical power output from the APCU is routed through Shuttle Orbiter equipment for AMS-02 or ISS use. The electrical deadfacing of any interfacing connectors when mating or demating shall comply with NSTS 08080-1, Standard 69. The APCU output shall be in the OFF state prior to mating or demating any APCU-powered loads. AMS-02 shall utilize the 124 Vdc output from two APCUs with their outputs paralleled.

3.2.1.1.2 APCU Output Power Characteristics

AMS-02 shall comply with the following APCU power characteristics:

- Maximum continuous output current: 29.4 Amps
- Over-current protection: Current limiting at 29.4 to 44 Amps for a minimum of 100 milliseconds, followed by a shutdown between 100 and 300 milliseconds

- Maximum continuous output power: 3600 Watts
- Peak output power: 3600 Watts
- Output Voltage: 124 +2.5 / -2 Vdc
- Overvoltage protection: Power conversion shuts down within 10 microseconds if the output voltage exceeds 153 +/- 2 Vdc or power conversion shuts down within 2 milliseconds if the output voltage exceeds 130.5 +/- 2.3 Vdc for 2.5 +/- 0.5 milliseconds
- Failure tolerance: 0
- Maximum ripple: 1.5 Volts peak to peak
- Total Periodic and random deviations: 3.0 Volts peak to peak
- Undervoltage Protection: Power conversion shuts down within 5 milliseconds after output voltage falls between 115 +/- 2.5 Vdc and 15 +/- 0.33 Vdc for 50 to 55 milliseconds.

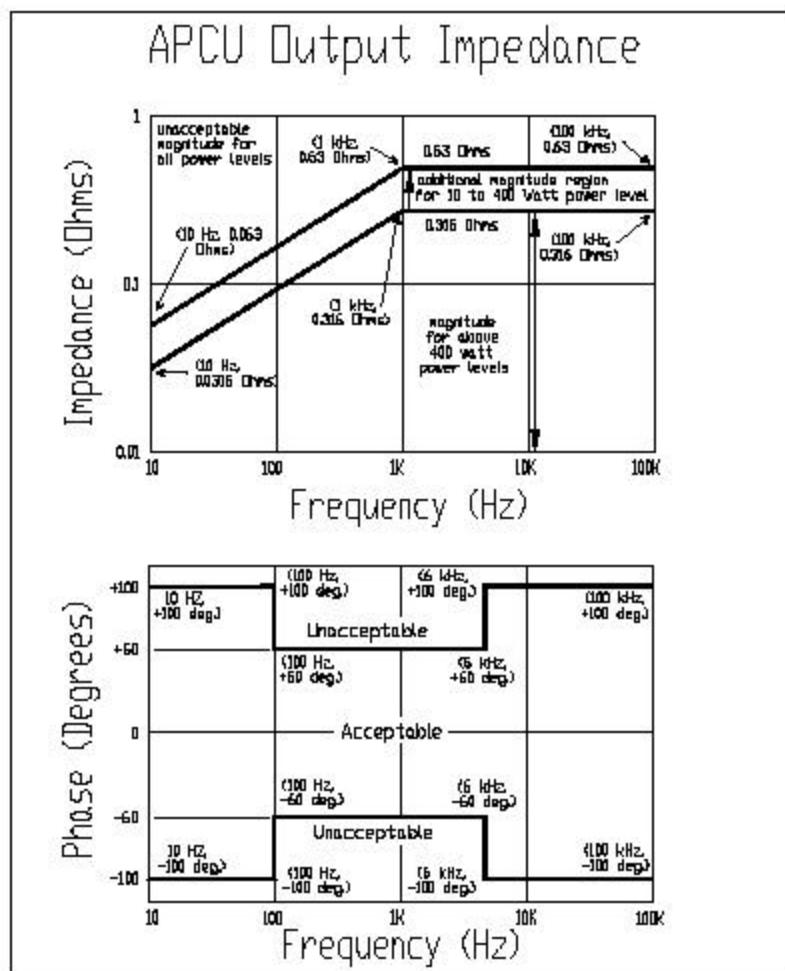


Figure 3.2.1.1.1.2-1 APCU 124 Vdc Output Power Characteristics

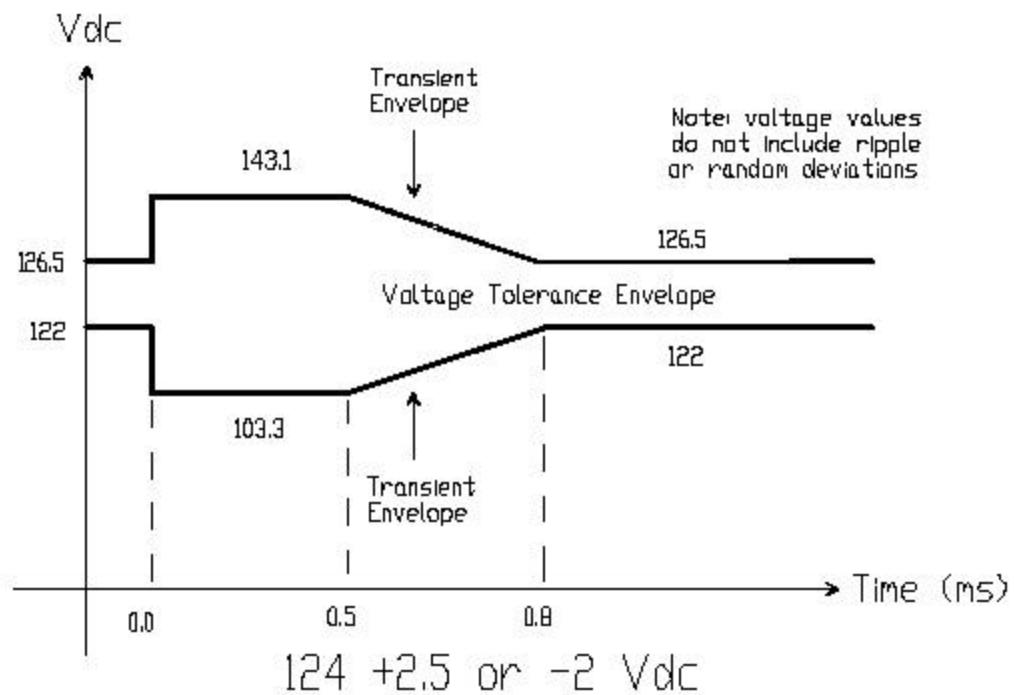


Figure 3.2.1.1.1.2-2 APCU 124 Vdc Output Power Characteristics

3.2.1.1.2 T-0 120 Vdc Power

AMS-02 receives the GSE 120 VDC power from the T-0 through connector J215 on the Interface Panel A. The interface connector pin assignment shall be as shown in Table 3.2.1.1.2-1.

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J215

INTEG HW CONN ID: J215
 INTERFACE DESCRIPTION: T-0 POWER
 INTEG HW CONN PART NO: NB0E18-8SNT2 (ITT CANNON EQUIV P/N IS PV0G18B8SN16)
 INTEG HW CABLE PART NO: *TBDL
 P/L CONN ID: P215
 P/L CONN PART NO: NB6GE18-8PNT2 (ITT CANNON EQUIV P/N IS PV6B18S8PN16)
 P/L CABLE NO. *TBDA
 P/L CABLE DIA (IN): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
HO	PWR	2T1	12	A	T-0 DC PWR	120 VDC T-0 MN PWR CH1	
HO	RTN	2T1	12	B	T-0 DC PWR RTN	120 VDC T-0 MN PWR CH1 RTN	
HO	PWR	2T2	12	C	T-0 DC PWR	120 VDC T-0 MN PWR CH2	
HO	RTN	2T2	12	D	T-0 DC PWR RTN	120 VDC T-0 MN PWR CH2 RTN	
HO	PWR	2T3	12	E	EGSE SENSELINE	SENSELINE POSITIVE	
HO	RTN	2T3	12	F	EGSE SENSELINE RTN	SENSELINE NEGATIVE	
				G	NOT WIRED	NOT WIRED	
				H	NOT WIRED	NOT WIRED	

GLOSSARY:

CABLE DESC: 2TX TWISTED PAIRS

*TBDL TO BE DETERMINED BY LOCKHEED MARTIN
 *TBDA TO BE DETERMINED BY AMS PAYLOAD

TABLE 3.2.1.1.2-1 T-0 120 VDC POWER PIN ASSIGNMENTS

3.2.1.1.2.1 AMS-02 GSE Power

GSE power via the T-0 umbilical is independent of Orbiter power distribution subsystems. Utilization of T-0 wires for commands and signals requires that these functions meet the EMC criteria (including voltage limits) specified in Table 3.2.1.1.2.1-1 GSE power shall be provided in accordance with the following paragraphs.

Freq. or Rise/Fall Time	Source Impedance (ohms)	Load Impedance (ohms)	Voltage or Sensitivity	Circuit Classification	Wire Type Reqd	Shield Grounding Reqmts
Analog, Alternating or Direct Current	<100	100-600k	>100mv to ±6v	ML	TWS	SPG**
		0-200	>6v to ±40v	HO	TW	None
		0-200	>40v	EO	TW	None
	±2.5k	100-600k	±100 mv	ML	TWS	SPG
		>600k			TWDS	SPG
	<100	±200	>100mv to ±6v	ML	TWS	SPG
		±200	>6v to ±40v	HO	TW	None
		±200	>40v	EO	TW	None
	±50 KHz and Rise and Fall Time	±10k	±6v	ML	TWS	SPG
		0-200	>6v to ±40v	HO	TW	None
		0-200	>40v	EO	TW	None
±10 Micro Seconds	<2.5k	100-600k	±100mv	ML	TWS	SPG
		>600k			TWDS	SPG
>50 KHz and ±1.024 MHz or Rise/ Fall Time	All	±200	>100mv to ±6v	ML	TWS	SPG**
		>200	>6v to ±40v	HO	TW	None
		>200	>40v	EO	TW	None
±10 Micro Seconds	All	All	±100mv	RF	TWDS*	MPG
		All	>100mv to ±6v	RF	TWS*	MPG
					TWDS	MPG
>1.024 MHz	All	All	All	RF	COAX	MPG
TV Video				RF	TWS	MPG***
Symbols Used						
KHz	- Kilohertz	RF	- Radio Frequency	<	- less than	
MHz	- Megahertz	TWS	- Twisted Shielded	≤	- less than or	
SPG	- Single Point Ground	mv	- Millivolts	=	equal to	
MPG	- Multiple Point Ground	v	- Volts	>	- greater than	
TW	- Twisted	coax	- coaxial	≥	- greater than	
TWDS	- Twisted Double Shielded	k	- Kilo		or equal to	

- * If the capacitance per foot is critical, controlled-impedance wiring, special shielded-twisted-pair cables (nominal 75 ohms), should be used.
- ** If circuit is balanced by transformer, differential or optical, the shield shall be multi-point grounded to structure.
- *** Distance between shield grounds shall not exceed 18 meters.

TABLE 3.2.1.1.2.1-1 EMC CRITERIA

3.2.1.1.2.1 T-0 Wiring Characteristics

AMS-02 shall comply with the following T-0 wiring characteristics:

- Power returns must be twisted with corresponding hot wires.
- Returns shall be single-point grounded at AMS-02 (flight end) only.

- When wire bussing is utilized, current limiting (e.g. fusing, etc.) shall be provided for individual wires (hot side) at one end only when two wire pairs are utilized. When wire bussing of three or more wire pairs is utilized, current limiting shall be provided at each end of each wire pair (hot side only).
- From 30 minutes before launch until launch, the amount of current being transferred through the T-0 umbilical shall be limited to 500 millamps per circuit (wire pair).

3.2.1.1.3 T-0 28 Vdc Power

AMS-02 receives 28 VDC GSE power for operating the vent pump from the T-0 through connector J214 on the Interface Panel A. The interface connector pin assignment shall be as shown in Table 3.2.1.1.3-1.

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J214

INTEG HW CONN ID: J214
 INTERFACE DESCRIPTION: T-0 POWER VENT PUMP
 INTEG HW CONN PART NO: NB0E18-32SNT2 (ITT CANNON EQUIV P/N IS PV0G18B32SN16)
 INTEG HW CABLE PART NO: *TBDL
 P/L CONN ID: P214
 P/L CONN PART NO: NB6GE18-32PNT2 (ITT CANNON EQUIV P/N IS PV6B18S32PN16)
 P/L CABLE NO.: *TBDA
 P/L CABLE DIA (IN): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
HO	PWR	2T1	20	A	VAC PUMP PWR 1	VAC PUMP PWR 1	1
HO	RTN	2T1	20	B	VAC PUMP PWR 1 RTN	VAC PUMP PWR 1 RTN	1
HO	PWR	2T2	20	C	VAC PUMP PWR 2	VAC PUMP PWR 2	1
HO	RTN	2T2	20	D	VAC PUMP PWR 2 RTN	VAC PUMP PWR 2 RTN	1
HO	PWR	2T3	20	E	VAC PUMP PWR 3	VAC PUMP PWR 3	1
HO	RTN	2T3	20	F	VAC PUMP PWR 3 RTN	VAC PUMP PWR 3 RTN	1
HO	PWR	2T4	20	G	VAC PUMP PWR 4	VAC PUMP PWR 4	1
HO	RTN	2T4	20	H	VAC PUMP PWR 4 RTN	VAC PUMP PWR 4 RTN	1
HO	PWR	2T5	20	I	VAC PUMP PWR 5	VAC PUMP PWR 5	1
HO	RTN	2T5	20	J	VAC PUMP PWR 5 RTN	VAC PUMP PWR 5 RTN	1
HO	PWR	2T6	20	K	VAC PUMP PWR 6	VAC PUMP PWR 6	1
HO	RTN	2T6	20	L	VAC PUMP PWR 6 RTN	VAC PUMP PWR 6 RTN	1
HO	PWR	2T7	20	M	VAC PUMP PWR 7	VAC PUMP PWR 7	1
HO	RTN	2T7	20	N	VAC PUMP PWR 7 RTN	VAC PUMP PWR 7 RTN	1
HO	PWR	2T8	20	O	VAC PUMP PWR 8	VAC PUMP PWR 8	1
HO	RTN	2T8	20	P	VAC PUMP PWR 8 RTN	VAC PUMP PWR 8 RTN	1
HO	PWR	2T9	20	Q	SENSELINE POSITIVE	SENSELINE POSITIVE	1
HO	RTN	2T9	20	R	SENSELINE NEGATIVE	SENSELINE NEGATIVE	1
				S	NOT WIRED	NOT WIRED	
				T	NOT WIRED	NOT WIRED	
				U	NOT WIRED	NOT WIRED	
				V	NOT WIRED	NOT WIRED	
				W	NOT WIRED	NOT WIRED	
				X	NOT WIRED	NOT WIRED	
				Y	NOT WIRED	NOT WIRED	
				Z	NOT WIRED	NOT WIRED	
				*A	NOT WIRED	NOT WIRED	
				*B	NOT WIRED	NOT WIRED	
				*C	NOT WIRED	NOT WIRED	
				*D	NOT WIRED	NOT WIRED	
				*E	NOT WIRED	NOT WIRED	
				*F	NOT WIRED	NOT WIRED	

GLOSSARY:

CABLE DESC: 2TX TWISTED PAIRS

*TBDL TO BE DETERMINED BY LOCKHEED MARTIN

*TBDA TO BE DETERMINED BY AMS PAYLOAD

NOTE 1: P/L shall limit current usage at umbilical separation to less than 500 mA.

TABLE 3.2.1.1.3-1 T-0 28 VDC POWER PIN ASSIGNMENTS

3.2.1.1.4 28 Vdc Ascent Power

AMS-02 receives 28 VDC ascent power from two powered maintained switches at the Standard Switch Panel (SSP) through connector J217 on the Interface Panel A. The interface connector pin assignment shall be as shown in Table 3.2.1.1.4-1. SSP shall be as shown in figure 3.2.1.1.4-2.

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J217

INTEG HW Conn ID: J217
 INTERFACE DESCRIPTION: 28 Vdc Ascent Power
 INTEG HW Conn Part No: NLS0T12-35S (ITT CANNON EQUIV P/N IS KJ3T12N35SN16)
 INTEG HW Cable Part No: *TBDL
 P/L Conn ID: P217
 P/L Conn Part No: NLS6GT12-35P (ITT CANNON EQUIV P/N IS KJG6T12N35PN16)
 P/L Cable No. *TBDA
 P/L Cable Dia (In): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
HO	PWR	2T1	22	1	SFHe TANK VALVE PWR 1	SFHe TANK VALVE PWR 1	1
HO	RTN	2T1	22	2	SFHe TANK VALVE PWR 1 RTN	SFHe TANK VALVE PWR 1 RTN	1
HO	PWR	2T2	22	3	SFHe TANK VALVE PWR 2	SFHe TANK VALVE PWR 2	1
HO	RTN	2T2	22	4	SFHe TANK VALVE PWR 2 RTN	SFHe TANK VALVE PWR 2 RTN	1
				5	NOT WIRED	NOT WIRED	
				6	NOT WIRED	NOT WIRED	
				7	NOT WIRED	NOT WIRED	
				8	NOT WIRED	NOT WIRED	
				9	NOT WIRED	NOT WIRED	
				10	NOT WIRED	NOT WIRED	
				11	NOT WIRED	NOT WIRED	
				12	NOT WIRED	NOT WIRED	
				13	NOT WIRED	NOT WIRED	
				14	NOT WIRED	NOT WIRED	
				15	NOT WIRED	NOT WIRED	
				16	NOT WIRED	NOT WIRED	
				17	NOT WIRED	NOT WIRED	
				18	NOT WIRED	NOT WIRED	
				19	NOT WIRED	NOT WIRED	
				20	NOT WIRED	NOT WIRED	
				21	NOT WIRED	NOT WIRED	
				22	NOT WIRED	NOT WIRED	

GLOSSARY:

CABLE DESC: 2TX TWISTED PAIRS

*TBDL TO BE DETERMINED BY LOCKHEED MARTIN

*TBDA TO BE DETERMINED BY AMS PAYLOAD

NOTE 1: P/L SHALL LIMIT CURRENT USAGE TO LESS THAN 5 AMP.

TABLE 3.2.1.1.4-1 28 VDC ASCENT POWER PIN ASSIGNMENTS

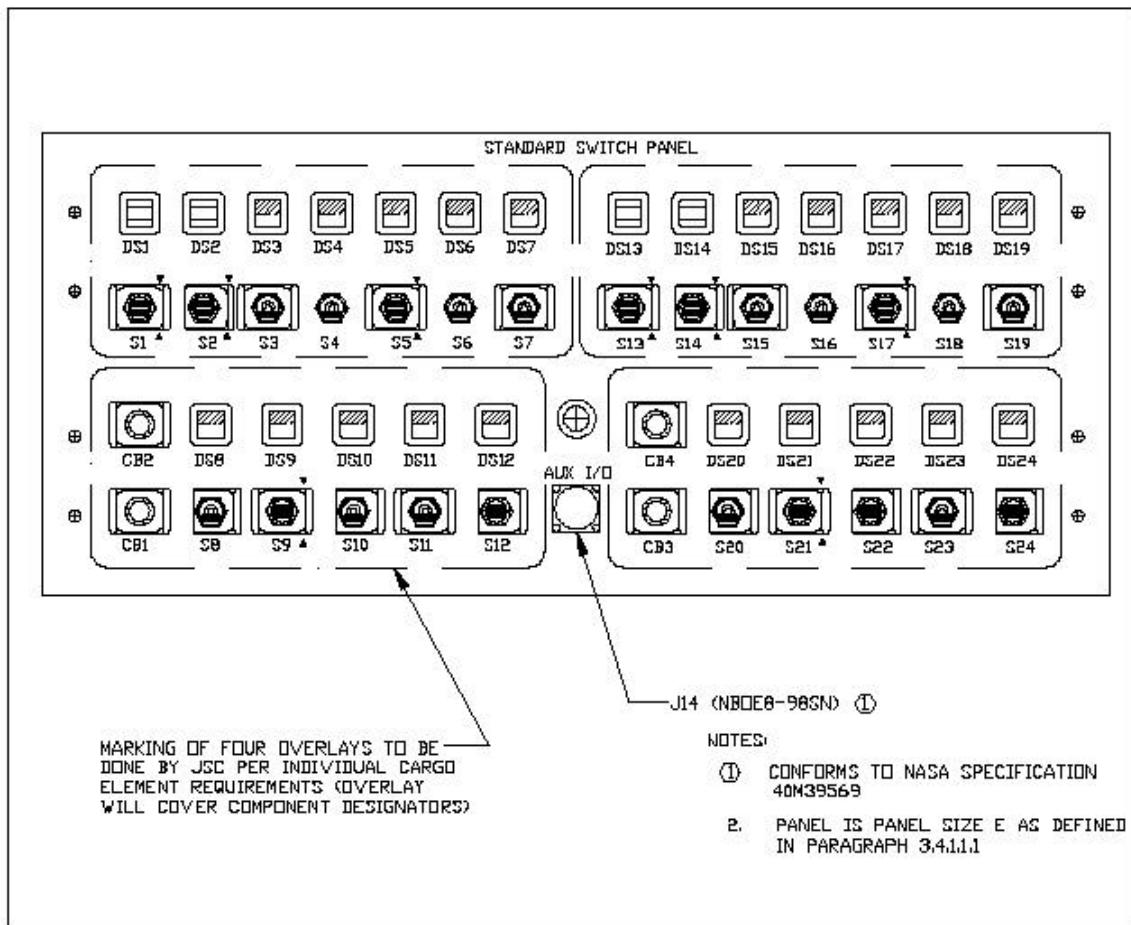


Figure 3.2.1.1.4-2 Standard Switch Panel Layout

3.2.1.2 Command And Data Handling

There are two connectors on the Interface Panel A for Command and Data Handling (CD&H), one for Back-up Flight System (BFS) command and one for the RS422 connection.

3.2.1.2.1 Back-Up Flight System

The Backup Flight System provides a secondary actuation for Super Fluid Helium tank vent valve. The barometric switch shall serve as the primary actuator. The backup

system will receive the time-tagged command via the Backup Flight System (BFS) General Purpose Computer (GPC) to open the vent valves. In the event of an abort during ascent, the time-tagged command via the BFS GPC will also serve to close the vent valves. These commands shall be provided as Low-level Discrete Outputs (DOL) via MDM through connector J206 on the Interface Panel A. The interface connector pin assignment shall be as shown in Table 3.2.1.2.1-1.

3.2.1.2.1.1 Low Level Discrete Outputs (DOL)

The electrical interface characteristics of the MDM low-level discrete output commands at the Orbiter/payload interfaces shall be as shown in Table 3.2.1.2.1.1-1.

Parameter	Dimension	Characteristics Orbiter/Payload Interface		Notes
Type		Single-Ended Discrete		Load isolated (1)
Code		Step-Level (Software Programmed)		
Analog Range				
Min	Volt	N/A		
Max	Volt			
Discrete- False	Min	Volt	-0.5	(1)
("0")	Max	Volt	+0.5	(1)
Discrete- True	Min	Volt	+4.0	(1) (5)
("1")	Max	Volt	+6.0	
Ripple and Noise		Milli- Volt		
Max		400		
CMV	Max	Volt	N/A	
Rise/Fall Time	Min	Microsec	1	(2)
(10 to 90 percent)				
Max		Microsec	20	(2)
Noise Suppression Bandwidth		Hertz	N/A	
Roll-off Rate	Min	dB/Octave	N/A	
CMRR		dB	N/A	
Distortion			N/A	
Frequency	Mbps		N/A	
Bit Rate	Mbps		N/A	
Transfer		Direct Coupled		Grounded at Orbiter

**TABLE 3.2.1.2.1.1-1 LOW-LEVEL DISCRETE OUTPUT (DOL)/ORBITER-TO-
PAYLOAD, ELECTRICAL INTERFACE CHARACTERISTICS**

Parameter	Dimension	Characteristics Orbiter/Payload Interface	Notes
Source Impedance Min	Ohm	30	
(Orbiter) Max	Ohm	100	
Load Impedance Min	Ohm	600	
(Payload) Max	Ohm	4K	(3)
Capacitance Max	Pico-Farad	3500	Payload not to exceed 1500
Pwr. Off Impedance Min	Ohm	10k (+6 Vdc)	Payload shall exceed 600
Current Drive	Milliamp	10 (Logic "1")	
Current Sink	Milliamp	-10 (Logic "0")	±0.5 volts
Overvoltage Protection			
Max	Volt	±32	(4)
Fault Voltage Emission Max	Volt	±15	(4)
Fault Current Limitation			
Max	Milliamp	±20	
Power-Ground Isolation	Megohms	10	

Notes:

0.2 millisecond state uncertainty maximum following power up.

- (1) Reference MDM Signal Ground
- (2) 400 OHM; 5 percent in parallel with 5 nanofarad; 10 percent load
- (3) An open input shall not result in an ambiguous logic state
- (4) Line-to-line and line to ground
- (5) Applies only when no more than 32 of 48 DOL outputs on a given module are set true simultaneously. (If more than 32 outputs are set true simultaneously then all outputs will be set to "0" volts due to power supply overload.)

TABLE 3.2.1.2.1.1-1 LOW-LEVEL DISCRETE OUTPUT (DOL)/ORBITER-TO-PAYOUT, ELECTRICAL INTERFACE CHARACTERISTICS (CONT.)

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J206

INTEG HW CONN ID: J206
 INTERFACE DESCRIPTION: BFS / GPC COMMAND
 INTEG HW CONN PART NO: NLS0T12-35SA (ITT CANNON EQUIV P/N IS KJ3T12N35SA16)
 INTEG HW CABLE PART NO: *TBDL
 P/L CONN ID: P206
 P/L CONN PART NO: NLS6GT12-35PA (ITT CANNON EQUIV P/N IS KJG6T12N35PA16)
 P/L CABLE NO.: *TBDA
 P/L CABLE DIA (IN): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
ML	SIG	2S1	22	1	DOL 1	AMS VALVE CMD1	1
ML	RTN	2S1	22	2	DOL 1 RTN	AMS VALVE CMD1 RTN	1
ML	SIG	2S2	22	3	DOL 2	AMS VALVE CMD2	1
ML	RTN	2S2	22	4	DOL 2 RTN	AMS VALVE CMD2 RTN	1
				5	NOT WIRED	NOT WIRED	
				6	NOT WIRED	NOT WIRED	
				7	NOT WIRED	NOT WIRED	
				8	NOT WIRED	NOT WIRED	
				9	NOT WIRED	NOT WIRED	
				10	NOT WIRED	NOT WIRED	
				11	NOT WIRED	NOT WIRED	
				12	NOT WIRED	NOT WIRED	
				13	NOT WIRED	NOT WIRED	
				14	NOT WIRED	NOT WIRED	
				15	NOT WIRED	NOT WIRED	
				16	NOT WIRED	NOT WIRED	
				17	NOT WIRED	NOT WIRED	
				18	NOT WIRED	NOT WIRED	
				19	NOT WIRED	NOT WIRED	
				20	NOT WIRED	NOT WIRED	
				21	NOT WIRED	NOT WIRED	
				22	NOT WIRED	NOT WIRED	

GLOSSARY: CABLE DESC: 2SX TWISTED SHIELDED PAIRS

*TBDL TO BE DETERMINED BY LOCKHEED MARTIN

*TBDA TO BE DETERMINED BY AMS PAYLOAD

NOTE 1: ALL INDIVIDUAL SHIELD SHALL BE CONNECTED AND TERMINATED WITHIN THE BACKSHELL

TABLE 3.2.1.2.1-1 BFS/GPC PIN ASSIGNMENTS

3.2.1.2.2 Mil-Std-1553

AMS will access the Shuttle 1553 connection through the EVA Panel. See Section 3.3.1.2 Command and Data Handling for details.

The OIU shall provide the MIL-STD-1553B data bus and shall be in accordance with the physical, electrical and protocol standards of MIL-STD-1553B. The OIU shall be capable of functioning as a bus controller (BC) or remote terminal (RT) on any local bus interface.

3.2.1.2.3 High Rate Data RS-422

AMS shall utilize two RS422 channels to communicate with Digital Data Recorder System (DDRS-2), the KU-band on the Shuttle and the T-0 for ground processing through connector J205 on the Interface Panel A. Cables shall be provided by PIH to perform the switching between T-0 and DDRS-02 at the Payload Distribution Interface Panel (PDIP). The interface connector pin assignment shall be as shown in Table 3.2.1.2.3-1.

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J205

INTEG HW Conn ID: J205
 INTERFACE DESCRIPTION: RS422
 INTEG HW Conn Part No: NLS0T12-35SB (ITT CANNON EQUIV P/N IS KJ3T12N35SB16)
 INTEG HW Cable Part No: *TBDL
 P/L Conn ID: P205
 P/L Conn Part No: NLS6GT12-35PB (ITT CANNON EQUIV P/N IS KJG6T12N35PB16)
 P/L Cable No.: *TBDA
 P/L Cable Dia (In): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
RF	SIG	2S1	22	1	RS422 TX1 +	RS422 TX1 +	1
RF	RTN	2S1	22	2	RS422 TX1 -	RS422 TX1 -	1
RF	SIG	2S2	22	3	RS422 RX1 +	RS422 RX1 +	1
RF	RTN	2S2	22	4	RS422 RX1 -	RS422 RX1 -	1
RF	SIG	2S3	22	5	RS422 TX1 CLK +	RS422 TX1 CLK +	1
RF	RTN	2S3	22	6	RS422 TX1 CLK -	RS422 TX1 CLK -	1
RF	SIG	2S4	22	7	RS422 RX1 CLK +	RS422 RX1 CLK +	1
RF	RTN	2S4	22	8	RS422 RX1 CLK -	RS422 RX1 CLK -	1
RF	SIG	2S5	22	9	GND 1	GND 1	1,2
RF	RTN	2S5	22	10	GND 2	GND 2	1,2
RF	SIG	2S6	22	11	RS422 TX2 +	RS422 TX2 +	1
RF	RTN	2S6	22	12	RS422 TX2 -	RS422 TX2 -	1
RF	SIG	2S7	22	13	RS422 RX2 +	RS422 RX2 +	1
RF	RTN	2S7	22	14	RS422 RX2 -	RS422 RX2 -	1
RF	SIG	2S8	22	15	RS422 TX2 CLK +	RS422 TX2 CLK +	1
RF	RTN	2S8	22	16	RS422 TX2 CLK -	RS422 TX2 CLK -	1
RF	SIG	2S9	22	17	RS422 RX2 CLK +	RS422 RX2 CLK +	1
RF	RTN	2S9	22	18	RS422 RX2 CLK -	RS422 RX2 CLK -	1
				19	NOT WIRED	NOT WIRED	
				20	NOT WIRED	NOT WIRED	
				21	NOT WIRED	NOT WIRED	
				22	NOT WIRED	NOT WIRED	

GLOSSARY: CABLE DESC: 2SX TWISTED SHIELDED PAIRS

*TBDL TO BE DETERMINED BY LOCKHEED MARTIN

*TBDA TO BE DETERMINED BY AMS PAYLOAD

NOTE 1: ALL INDIVIDUAL SHIELD SHALL BE CONNECTED AND TERMINATED WITHIN THE BACKSHELL

NOTE 2: THE GROUND WIRE FOR CHANNEL 1 AND CHANNEL 2 ARE IN THE SAME TWISTED PAIR

TABLE 3.2.1.2.3-1 RS 422 PIN ASSIGNMENTS

3.3 AMS-02 TO THE INTERNATIONAL SPACE STATION INTERFACE

When AMS-02 payload is attached to the ISS, the UMA will be utilized to provide the electrical & CD&H interface between the ISS and the AMS-02 payload. The interface between the PIH and the AMS-02 payload shall be located at the EVA Panel.

3.3.1 EVA Interface Panel

The EVA Interface Panel shall be located on the lower Unique Support Structure (USS) next to the UMA as shown in Figure 3.3.1-1. The EVA Panel Assembly contains 10 connectors. Their reference designators and function are listed in Table 3.3.1-3. AMS-02 shall interface to J121, J122, J101A, J101B, J103 and J104 only. The EVA Interface Panel layout is shown in Figure 3.3.1-2.

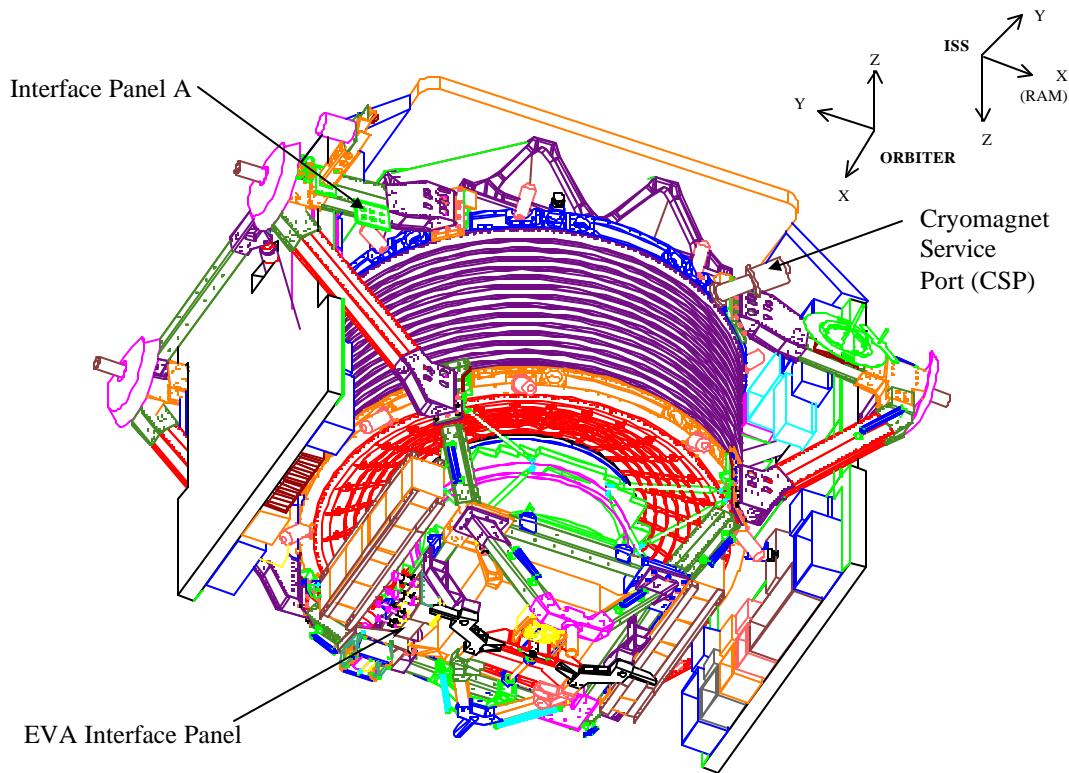


Figure 3.3.1-1 EVA Panel Location (1 of 5)

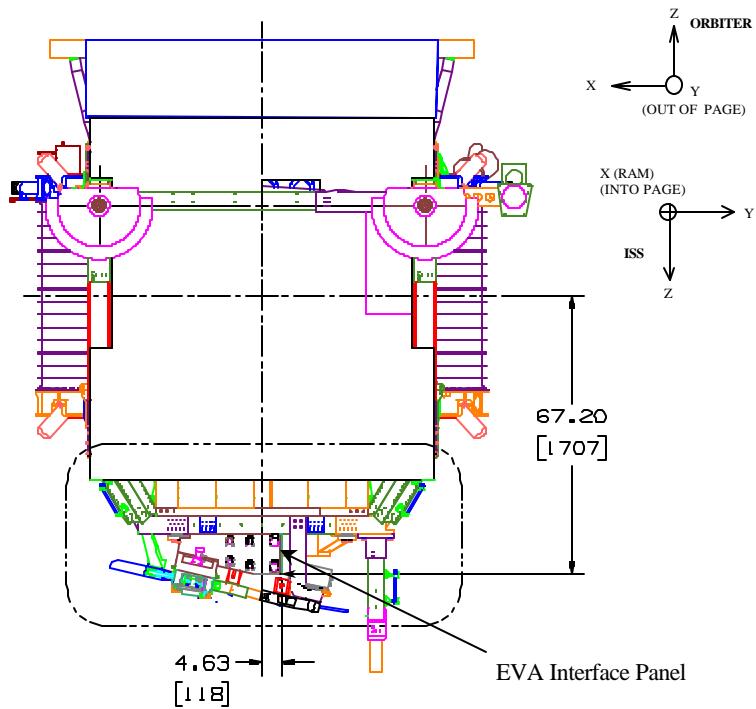


Figure 3.3.1-1 EVA Panel Location (2 of 5)

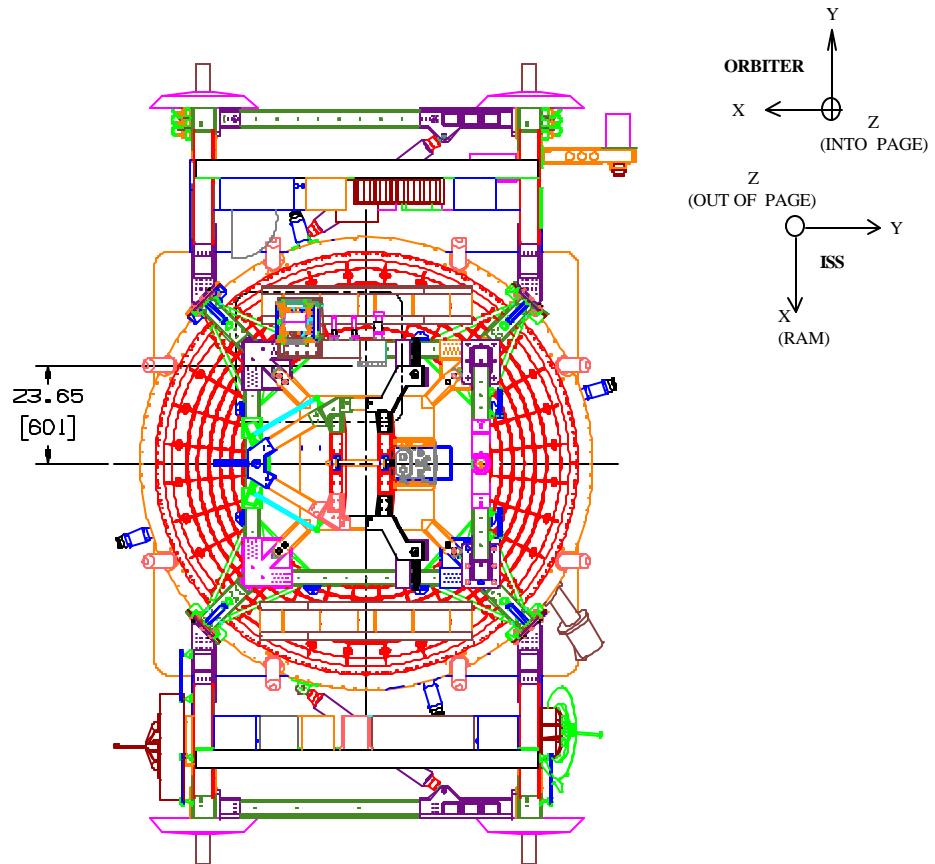


Figure 3.3.1-1 EVA Panel Location (3 of 5)

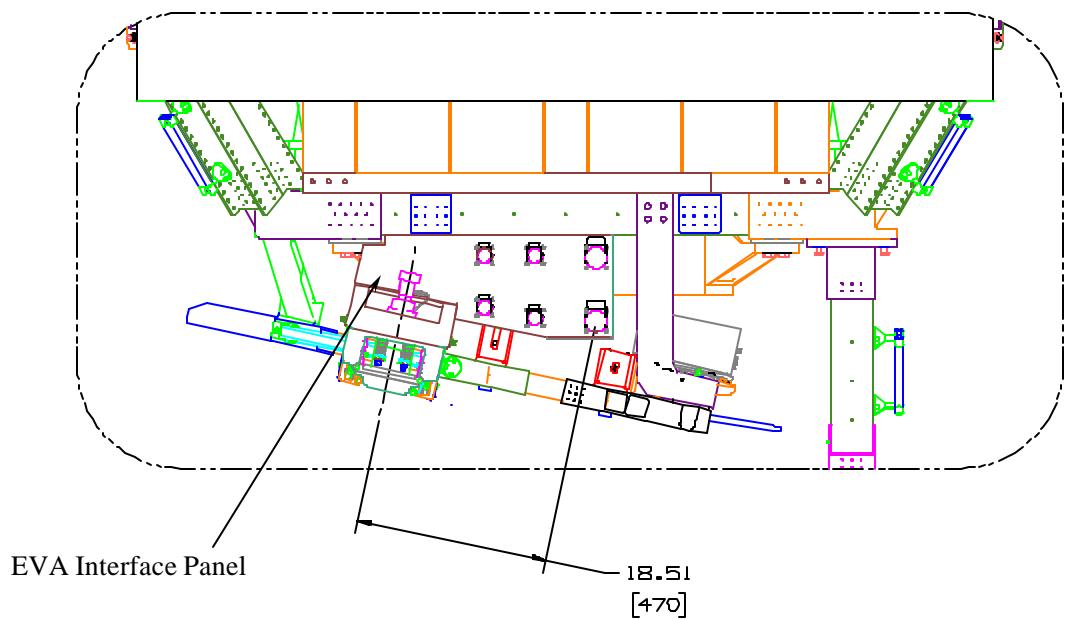


Figure 3.3.1-1 EVA Panel Location (4 of 5)

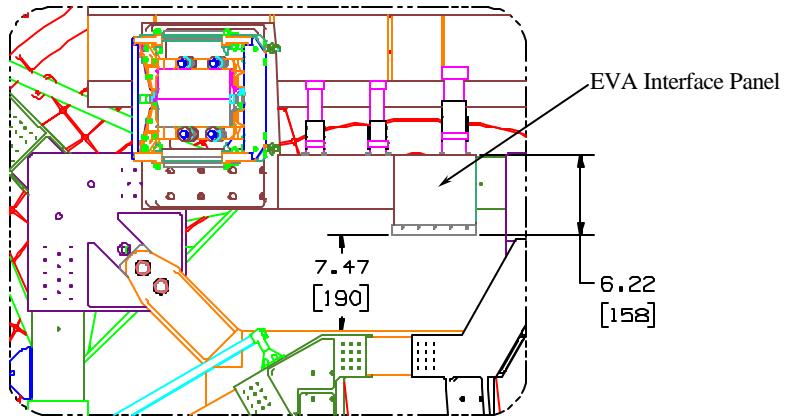


Figure 3.3.1-1 EVA Panel Location (5 of 5)

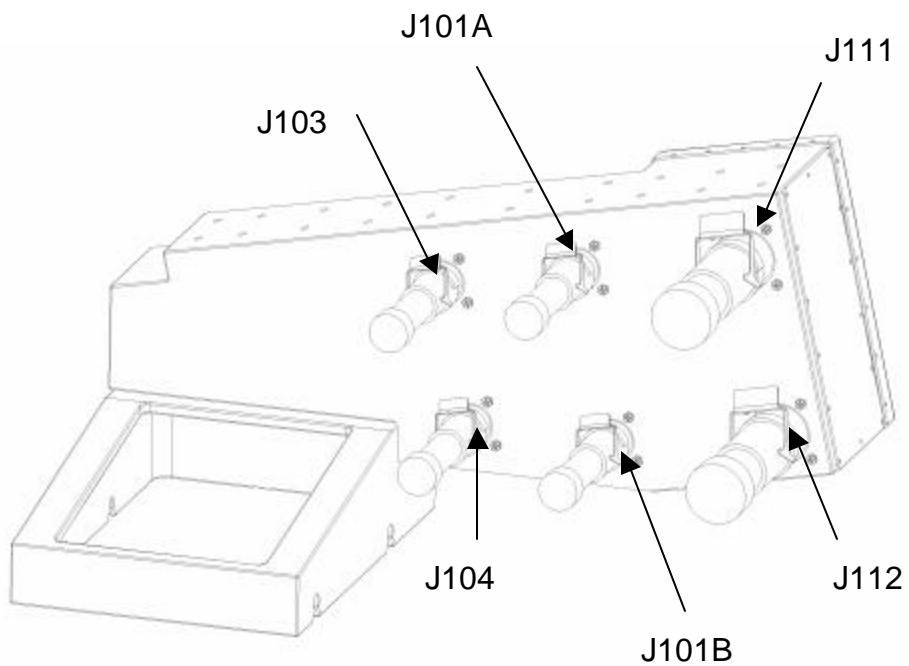


Figure 3.3.1- 2 EVA Interface Panel Layout (1 of 2)

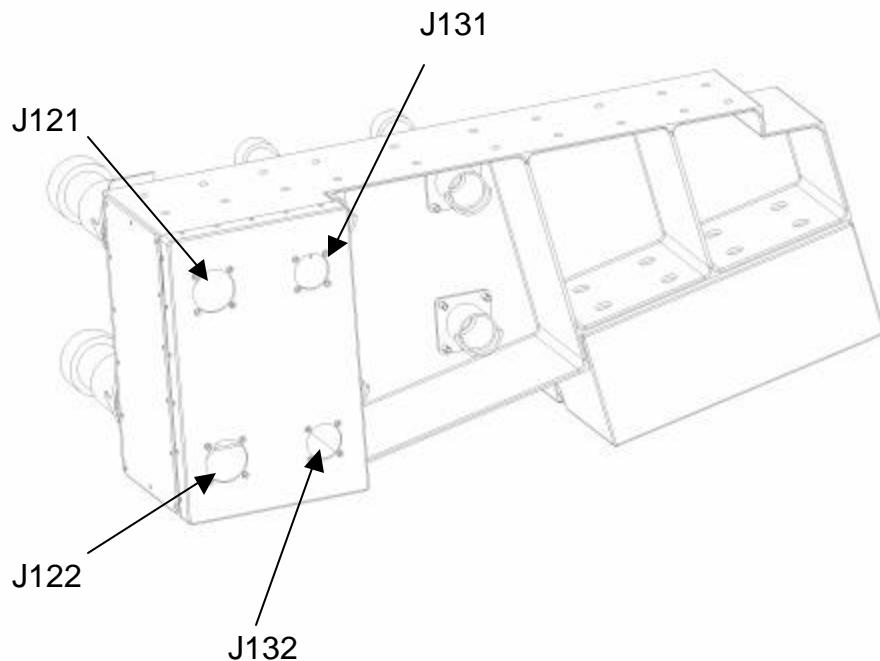


Figure 3.3.1- 2 EVA Interface Panel Layout (2 of 2)

REF DESIG.	FUNCTION	TYPE OF CONNECTOR
J111	PWR	EVA
J112	PWR	EVA
J101A	FIBER OPTIC	EVA
J101B	FIBER OPTIC	EVA
J103	1553	EVA
J104	1553	EVA
J131	HEATER PWR	STANDARD MIL-TYPE
J132	HEATER PWR	STANDARD MIL-TYPE
J121	PWR BUS A	STANDARD MIL-TYPE
J122	PWR BUS B	STANDARD MIL-TYPE

TABLE 3.3.1-3 EVA INTERFACE PANEL CONNECTORS

3.3.1.1 Power

AMS-02 shall meet the electrical interface requirements as listed in Section 3.2 of SSP 57003, Attached Payload Interface Requirement Document.

3.3.1.1.1 ISS Secondary Power 120 Vdc (Power A Feed)

AMS-02 shall access ISS secondary power (Power A Feed) through J121 connector on the EVA Interface Panel. The interface connector pin assignment shall be as shown in Table 3.3.1.1.1-1.

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J121

INTEG HW CONN ID: J121
INTERFACE DESCRIPTION: ISS SECONDARY PWR (Power A Feed)
INTEG HW CONN PART NO: ME414-0234-7246 (ITT CANNON EQUIV P/N IS CVA0R2222S16)
INTEG HW CABLE PART NO: *TBDL
P/L CONN ID: P121
P/L CONN PART NO: ME414-0235-7247 (ITT CANNON EQUIV P/N IS CVA6R2222P16)
P/L CABLE NO. *TBDA
P/L CABLE DIA (IN): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
EO	PWR	2T1	8	A	PWR A 120 VDC (+)	PWR A 120 VDC (+)	
				B	NOT WIRED	NOT WIRED	
EO	RTN	2T1	8	C	PWR A RTN	PWR A RTN	
EO	GND	SC1	8	D	FAULT GND	FAULT GND	

GLOSSARY:

CABLE DESC: 2TX TWISTED PAIRS

CABLE DESC: SCX SINGLE CONDUCTOR

*TBDL TO BE DETERMINED BY LOCKHEED MARTIN

*TBDA TO BE DETERMINED BY AMS PAYLOAD

TABLE 3.3.1.1.1-1 ISS SECONDARY POWER 120 VDC (POWER A FEED)

3.3.1.1.2 ISS Secondary Power 120 Vdc (Power B Feed)

AMS-02 shall access ISS secondary power (Power B feed) through J122 connector on the EVA Interface Panel. The connector pin assignment shall be as shown in Table 3.3.1.1.2-1.

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J122

INTEG HW CONN ID: J122
 INTERFACE DESCRIPTION: ISS SECONDARY PWR (POWER B FEED)
 INTEG HW CONN PART NO: ME414-0234-7246 (ITT CANNON EQUIV P/N IS CVA0R2222S16)
 INTEG HW CABLE PART NO: *TBDL
 P/L CONN ID: P122
 P/L CONN PART NO: ME414-0235-7247 (ITT CANNON EQUIV P/N IS CVA6R2222P16)
 P/L CABLE NO. *TBDA
 P/L CABLE DIA (IN): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
EO	PWR	2T1	8	A	PWR B 120 VDC (+)	PWR B 120 VDC (+)	
				B	NOT WIRED	NOT WIRED	
EO	RTN	2T1	8	C	PWR B RTN	PWR B RTN	
EO	GND	SC1	8	D	FAULT GND	FAULT GND	

GLOSSARY:

CABLE DESC: 2TX TWISTED PAIRS

CABLE DESC: SCX SINGLE CONDUCTOR

*TBDL TO BE DETERMINED BY LOCKHEED MARTIN

*TBDA TO BE DETERMINED BY AMS PAYLOAD

TABLE 3.3.1.1.2-1 ISS SECONDARY POWER 120 VDC (POWER B FEED)

3.3.1.2 Command And Data Handling

AMS-02 shall meet the command and data handling interface requirements as listed in Section 3.3 of SSP 57003, Attached Payload Interface Requirement Document.

3.3.1.2.1 1553 Interface

AMS-02 shall have access to the ISS 1553 bus and the shuttle 1553 bus at the EVA Interface Panel. J103, J104 shall be the reference designators for AMS-02 receptacles. J103 shall be pre-assigned as the ISS main 1553 interface and J104 shall be pre-assigned as the STS OIU 1553 interface. PIH shall have the plug type connectors and they will be designated P103 and P104. As a contingency, P103 and P104 shall provide interchangeability with J104 and J103 respectively. AMS-02 shall limit the 1553 stub length to 7.0 feet maximum.

3.3.1.2.1.1 1553 Data Interface A

AMS-02 shall have access to the ISS 1553 bus through J103 on the EVA Panel. The interface connector pin assignment shall be as shown in Table 3.3.1.2.1.1-1.

TITLE PIN ASSIGNMENTS FOR CONNECTOR J103

INTEG HW Conn ID: P103
 INTERFACE DESCRIPTION: 1553 DATA BUS
 INTEG HW Conn Part No: NZGL06G1513N35SA-1
 INTEG HW Cable Part No: *TBDL
 P/L Conn ID: J103
 P/L Conn Part No: NZGL00T1513N35PA
 P/L Cable No. *TBDA
 P/L Cable Dia (in): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
RF	DATA BUS 2A (+)	2S1	22	1	DATA BUS 2A STUB (+)	DATA BUS 2A (+)	1, 2
RF	DATA BUS 2A (-)	2S1	22	2	DATA BUS 2A STUB (-)	DATA BUS 2A (-)	1, 2
RF	SIG	2S2	22	3	RT ADDRESS BIT 0	RT ADDRESS BIT 0	2
RF	RTN	2S2	22	4	RT ADDRESS BIT 0 RTN	RT ADDRESS BIT 0 RTN	2
RF	SIG	2S3	22	5	RT ADDRESS BIT 1	RT ADDRESS BIT 1	2
RF	RTN	2S3	22	6	RT ADDRESS BIT 1 RTN	RT ADDRESS BIT 1 RTN	2
RF	SIG	2S4	22	7	RT ADDRESS BIT 2	RT ADDRESS BIT 2	2
RF	RTN	2S4	22	8	RT ADDRESS BIT 2 RTN	RT ADDRESS BIT 2 RTN	2
RF	SIG	2S5	22	9	RT ADDRESS BIT 3	RT ADDRESS BIT 3	2
RF	RTN	2S5	22	10	RT ADDRESS BIT 3 RTN	RT ADDRESS BIT 3 RTN	2
RF	SIG	2S6	22	11	RT ADDRESS BIT 4	RT ADDRESS BIT 4	2
RF	RTN	2S6	22	12	RT ADDRESS BIT 4 RTN	RT ADDRESS BIT 4 RTN	2
RF	SIG	2S7	22	13	PARITY BIT	PARITY BIT	2
RF	RTN	2S7	22	14	PARITY BIT RTN	PARITY BIT RTN	2
RF	DATA BUS 2B (+)	2S8	22	15	DATA BUS 2B STUB (+)	DATA BUS 2B (+)	1, 2
RF	DATA BUS 2B (-)	2S8	22	16	DATA BUS 2B STUB (-)	DATA BUS 2B (-)	1, 2
					NOT WIRED	NOT WIRED	
					NOT WIRED	NOT WIRED	
					NOT WIRED	NOT WIRED	
					NOT WIRED	NOT WIRED	
HO	SIG	2T1	22	21	MCC SENSE	MCC SENSE	
HO	RTN	2T1	22	22	MCC SENSE RTN	MCC SENSE RTN	

GLOSSARY:

CABLE DESC: 2TX TWISTED PAIRS
 CABLE DESC: 2SX TWISTED SHIELDED PAIRS

*TBDL TO BE DETERMINED BY LOCKHEED MARTIN
 *TBDA TO BE DETERMINED BY AMS PAYLOAD

NOTE 1: PAYLOAD END STUB LENGTH SHALL NOT EXCEED 7 FEET

NOTE 2: ALL INDIVIDUAL SHIELD SHALL BE CONNECTED AND TERMINATED WITHIN THE BACKSHELL

TABLE 3.3.1.2.1.1-1 1553 DATA INTERFACE A

3.3.1.2.1.2 1553 Data Interface B

AMS-02 shall have access to the Shuttle 1553 bus through J104 on the EVA Panel. As a contingency, this interface connector shall be interchangeable with 1553 Data Interface B, J103, 1553 data interface on the ISS in case of system malfunction. The interface connector pin assignment shall be as shown in Table 3.3.1.2.1.2-1.

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J104

INTEG HW CONN ID: P104
 INTERFACE DESCRIPTION: 1553 DATA BUS
 INTEG HW CONN PART NO: NZGL06G1513N35SA-1
 INTEG HW CABLE PART NO: *TBDL
 P/L CONN ID: J104
 P/L CONN PART NO: NZGL00T1513N35PA
 P/L CABLE NO.: *TBDA
 P/L CABLE DIA (IN): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
RF	DATA BUS 2A (+)	2S1	22	1	DATA BUS 2A STUB (+)	DATA BUS 2A (+)	2, 3
RF	DATA BUS 2A (-)	2S1	22	2	DATA BUS 2A STUB (-)	DATA BUS 2A (-)	2, 3
RF	SIG	2S2	22	3	RT ADDRESS BIT 0	RT ADDRESS BIT 0	3
RF	RTN	2S2	22	4	RT ADDRESS BIT 0 RTN	RT ADDRESS BIT 0 RTN	3
RF	SIG	2S3	22	5	RT ADDRESS BIT 1	RT ADDRESS BIT 1	1, 3
RF	RTN	2S3	22	6	RT ADDRESS BIT 1 RTN	RT ADDRESS BIT 1 RTN	1, 3
RF	SIG	2S4	22	7	RT ADDRESS BIT 2	RT ADDRESS BIT 2	1, 3
RF	RTN	2S4	22	8	RT ADDRESS BIT 2 RTN	RT ADDRESS BIT 2 RTN	1, 3
RF	SIG	2S5	22	9	RT ADDRESS BIT 3	RT ADDRESS BIT 3	1, 3
RF	RTN	2S5	22	10	RT ADDRESS BIT 3 RTN	RT ADDRESS BIT 3 RTN	1, 3
RF	SIG	2S6	22	11	RT ADDRESS BIT 4	RT ADDRESS BIT 4	1, 3
RF	RTN	2S6	22	12	RT ADDRESS BIT 4 RTN	RT ADDRESS BIT 4 RTN	1, 3
RF	SIG	2S7	22	13	PARITY BIT	PARITY BIT	1, 3
RF	RTN	2S7	22	14	PARITY BIT RTN	PARITY BIT RTN	1, 3
RF	DATA BUS 2B (+)	2S8	22	15	DATA BUS 2B STUB (+)	DATA BUS 2B (+)	2, 3
RF	DATA BUS 2B (-)	2S8	22	16	DATA BUS 2B STUB (-)	DATA BUS 2B (-)	2, 3
					NOT WIRED	NOT WIRED	
					NOT WIRED	NOT WIRED	
					NOT WIRED	NOT WIRED	
					NOT WIRED	NOT WIRED	
HO	SIG	2T1	22	21	SSP 28VDC	MCC SENSE	
HO	RTN	2T1	22	22	SSP 28VDC RTN	MCC SENSE RTN	

GLOSSARY:

*TBDA TO BE DETERMINED BY AMS PAYLOAD
 *TBDL TO BE DETERMINED BY LOCKHEED MARTIN
 CABLE DESC: 2TX TWISTED PAIRS
 CABLE DESC: 2SX TWISTED SHIELDED PAIRS

NOTE 1: JUMPERS (SINGLE CONDUCTORS) WILL BE INSTALLED ON PAYLOAD INTEG HW TO PROVIDE VALID RT ADDRESS PER ORBITER INTERFACE UNIT ASSIGNMENT.

NOTE 2: PAYLOAD END STUB LENGTH SHALL NOT EXCEED 7 FEET

NOTE 3: ALL INDIVIDUAL SHIELD SHALL BE CONNECTED AND TERMINATED WITHIN THE BACKSHELL

TABLE 3.3.1.2.1.2-1 1553 DATA INTERFACE B

3.3.1.2.2 Fiber Optic Interface

AMS shall utilize the high rate fiber optic data interface through connectors J101A and J101B on the EVA Panel. J101A shall be the primary interface and J101B shall be the secondary interface. The PIH shall have P101 as the reference designator. The wiring detail of the Fiber Optic interface shall be as shown in Figure 3.3.1.2.2-1.

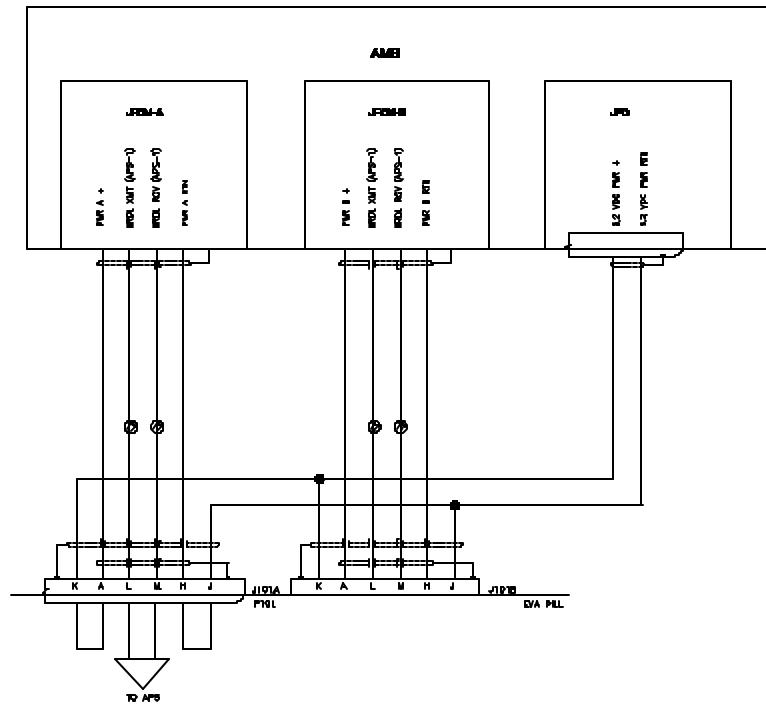


Figure 3.3.1.2.2-1 Fiber Optic Wiring Diagram

3.3.1.2.2.1 Primary Fiber Optic Interface

Connector J101A shall serve as the primary fiber optic interface. Jumpers shall be installed at the PIH connector for payload power detection. The interface connector pin assignment shall be as shown in Table 3.3.1.2.2.1-1.

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J101A

INTEG HW CONN ID: P101
 INTERFACE DESCRIPTION: FIBER OPTIC
 INTEG HW CONN PART NO: NZGL06G1515N97PN-1
 INTEG HW CABLE PART NO: *TBDL
 P/L CONN ID: J101A
 P/L CONN PART NO: NZGL00T1515N97SN
 P/L CABLE NO.: *TBDA
 P/L CABLE DIA (IN): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
FO	XMT	FO1	16	L	HRDL XMT (APS-1)	HRDL XMT	
FO	RCV	FO2	16	M	HRDL RCV (APS-1)	HRDL RCV	
ML	PWR	2S1	22	A	5.2 VDC PWR LOOPED BACK	PWR A +	1, 2
ML	RTN	2S1	22	H	5.2 VDC PWR RTN LOOPED BACK	PWR A RTN	1, 2
ML	PWR	2S2	22	K	5.2 VDC PWR	5.2 VDC PWR	1, 2
ML	RTN	2S2	22	J	5.2 VDC PWR RTN	5.2 VDC PWR RTN	1, 2
				B	NOT WIRED	NOT WIRED	
				C	NOT WIRED	NOT WIRED	
				D	NOT WIRED	NOT WIRED	
				E	NOT WIRED	NOT WIRED	
				F	NOT WIRED	NOT WIRED	
				G	NOT WIRED	NOT WIRED	

GLOSSARY:

CABLE DESC: FO-X FIBER OPTIC

CABLE DESC: 2SX TWISTED SHIELDED PAIRS

*TBDL TO BE DETERMINED BY LOCKHEED MARTIN

*TBDA TO BE DETERMINED BY AMS PAYLOAD

NOTE 1: JUMPER (SINGLE CONDUCTOR) SHALL BE INSTALLED ON INTEGR. HDW TO PROVIDE P/L POWER SENSING
 NOTE 2: ALL INDIVIDUAL SHIELD SHALL BE CONNECTED AND TERMINATED WITHIN THE BACKSHELL

TABLE 3.3.1.2.2.1-1 PRIMARY FIBER OPTIC INTERFACE

3.3.1.2.2.2 Secondary Fiber Optic Interface

Connector J101B shall serve as the secondary fiber optic interface. Jumpers shall be installed at the PIH connector for power detection. The interface connector pin assignment shall be as shown in Table 3.3.1.2.2.2-1.

TITLE: PIN ASSIGNMENTS FOR CONNECTOR J101B

INTEG HW Conn ID: P101
 INTERFACE DESCRIPTION: FIBER OPTIC
 INTEG HW Conn Part No: NZGL06G1515N97PN-1
 INTEG HW Cable Part No: *TBDL
 P/L Conn ID: J101B
 P/L Conn Part No: NZGL00T1515N97SN
 P/L Cable No. *TBDA
 P/L Cable Dia (in): *TBDA

EMC CLASS	PIN FUNCTION	CABLE DESC	AWG	PIN NO	INTEG HW FUNCTION	PAYLOAD FUNCTION	NOTE
FO	XMT	FO1	16	L	HRDL XMT (APS-1)	HRDL XMT	
FO	RCV	FO2	16	M	HRDL RCV (APS-1)	HRDL RCV	
ML	PWR	2S1	22	A	5.2 VDC PWR LOOPED BACK	PWR A +	1, 2
ML	RTN	2S1	22	H	5.2 VDC PWR RTN LOOPED BACK	PWR A RTN	1, 2
ML	PWR	2S2	22	K	5.2 VDC PWR	5.2 VDC PWR	1, 2
ML	RTN	2S2	22	J	5.2 VDC PWR RTN	5.2 VDC PWR RTN	1, 2
				B	NOT WIRED	NOT WIRED	
				C	NOT WIRED	NOT WIRED	
				D	NOT WIRED	NOT WIRED	
				E	NOT WIRED	NOT WIRED	
				F	NOT WIRED	NOT WIRED	
				G	NOT WIRED	NOT WIRED	

GLOSSARY:

CABLE DESC: FO-X FIBER OPTIC

CABLE DESC: 2SX TWISTED SHIELDED PAIRS

*TBDL TO BE DETERMINED BY LOCKHEED MARTIN

*TBDA TO BE DETERMINED BY AMS PAYLOAD

NOTE 1: JUMPER (SINGLE CONDUCTOR) IS INSTALLED ON INTEGR. HDW TO PROVIDE POWER SENSE

NOTE 2: ALL INDIVIDUAL SHIELD SHALL BE CONNECTED AND TERMINATED WITHIN THE BACKSHELL

TABLE 3.3.1.2.2.2-1 SECONDARY FIBER OPTIC INTERFACE

3.3.2 Direct Current Magnetic Fields

AMS-02 generated dc magnetic fields may exceed 170 decibel (dB) above 1 picotesla (3.16 gauss) at a distance of 7 cm from the external surfaces of the payload (pending ISS Electromagnetic Effects Panel approval).

4.0 MECHANICAL REQUIREMENTS

This section describes the mechanical and physical interfaces associated with the AMS Experiment and the PIH. All Dimensions are in inches [mm]. Dimensional tolerances are as follows (unless otherwise specified):

.0 = .1 [3]
.00 = .01 [.3]
.000 = .005 [.13]

4.1 PHYSICAL DEFINITION

4.1.1 PAYLOAD WEIGHT

The AMS-02 Payload weight shall not exceed 13,500 lbs (6124 kg). The estimated distribution is:

4.1.1.1 PIH INTEGRATION HARDWARE

The PIH Integration Hardware consists of the STS and ISS Hardware. The STS Hardware weighs 3215 lbs. (1458 kg) and the STS Hardware weighs 500 lbs. (227 kg).The STS weight includes the Unique Support Structure –02 and the Cryomagnet Vacuum Case.

4.1.1.2 EXPERIMENT

The AMS-02 experiment weight as a whole shall not exceed 9785 lbs. (4438 kg).

4.1.2 COORDINATE SYSTEM

The AMS-02 payload and AMS-02 experiment coordinate axis systems are identical and are shown in Figure 4.1.2-1. Dimensions are in inches.

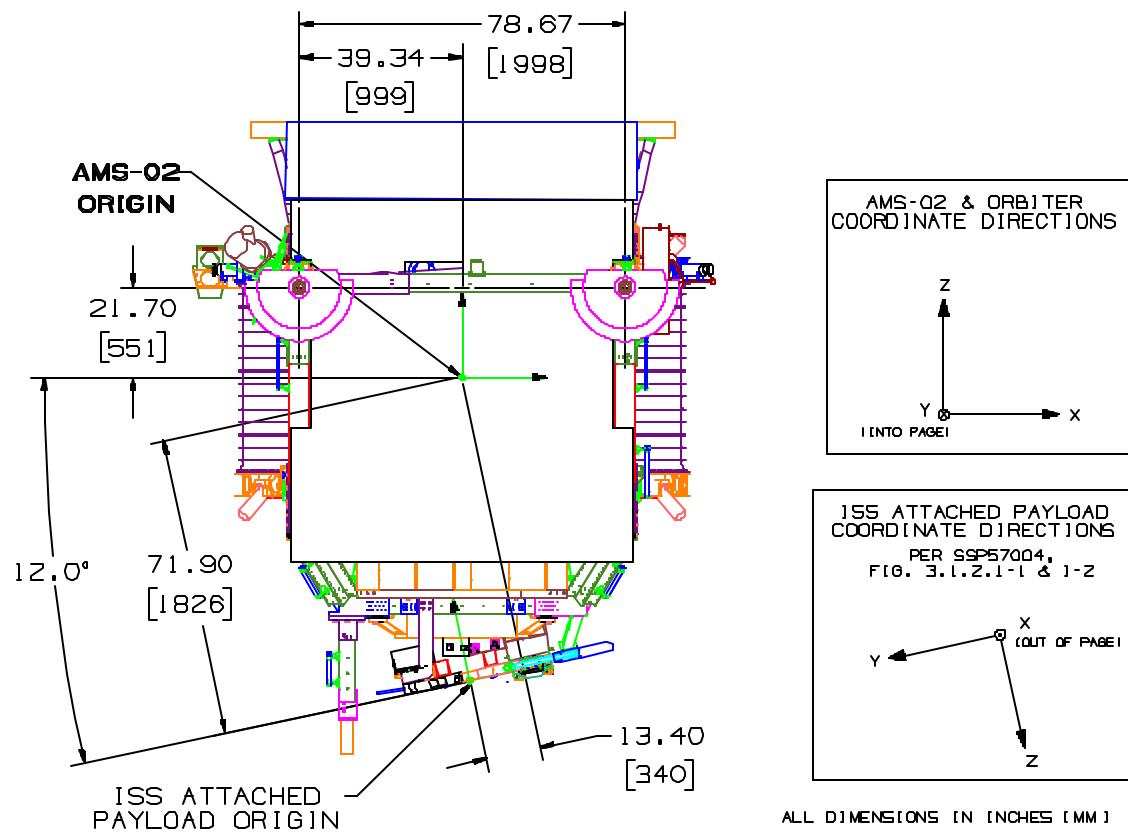


FIGURE 4.1.2-1 Coordinate System (1 of 2)

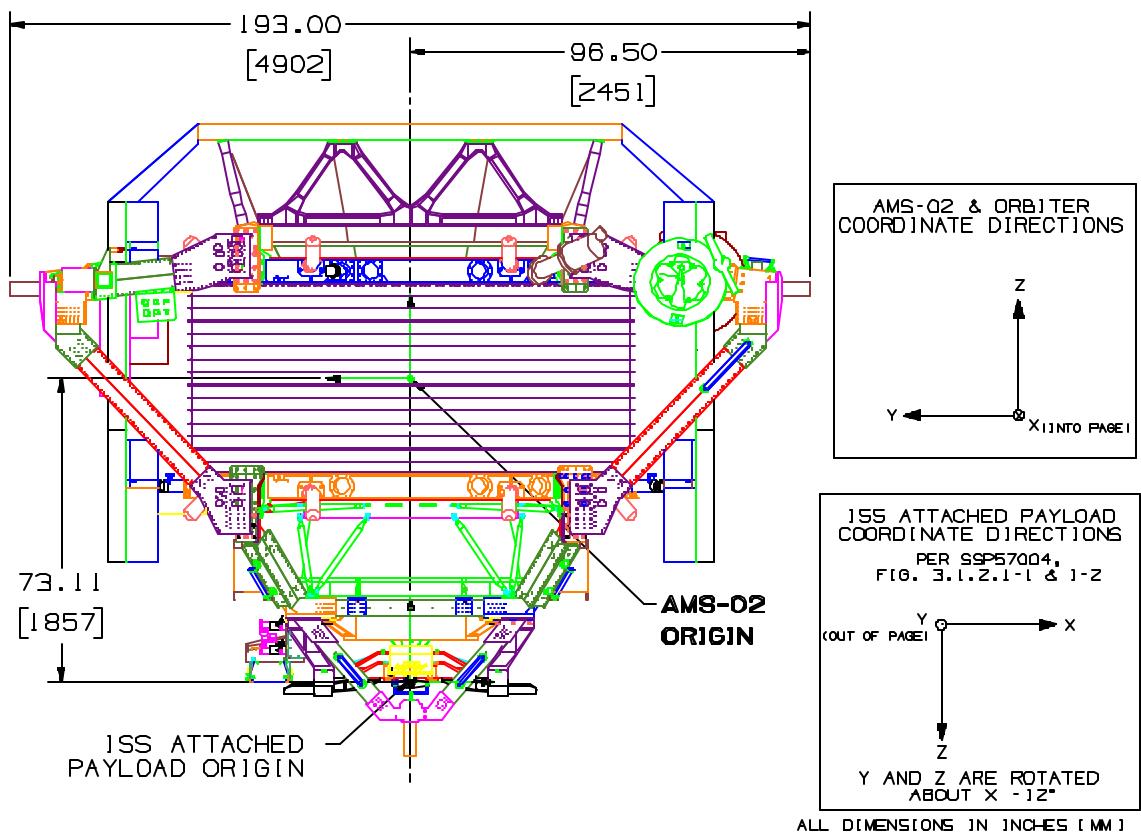


FIGURE 4.1.2-1 Coordinate System (2 of 2)

4.1.3 ENVELOPE

The envelope of the main assembly shall conform to Figure 4.1.3-1 and be contained in Figures 4.1.3-2 and 4.1.3-3. The envelopes represent AMS-02 Experiment hardware keep in volumes. These volumes along with the hardware contained in them shall be separable for shipping purposes.

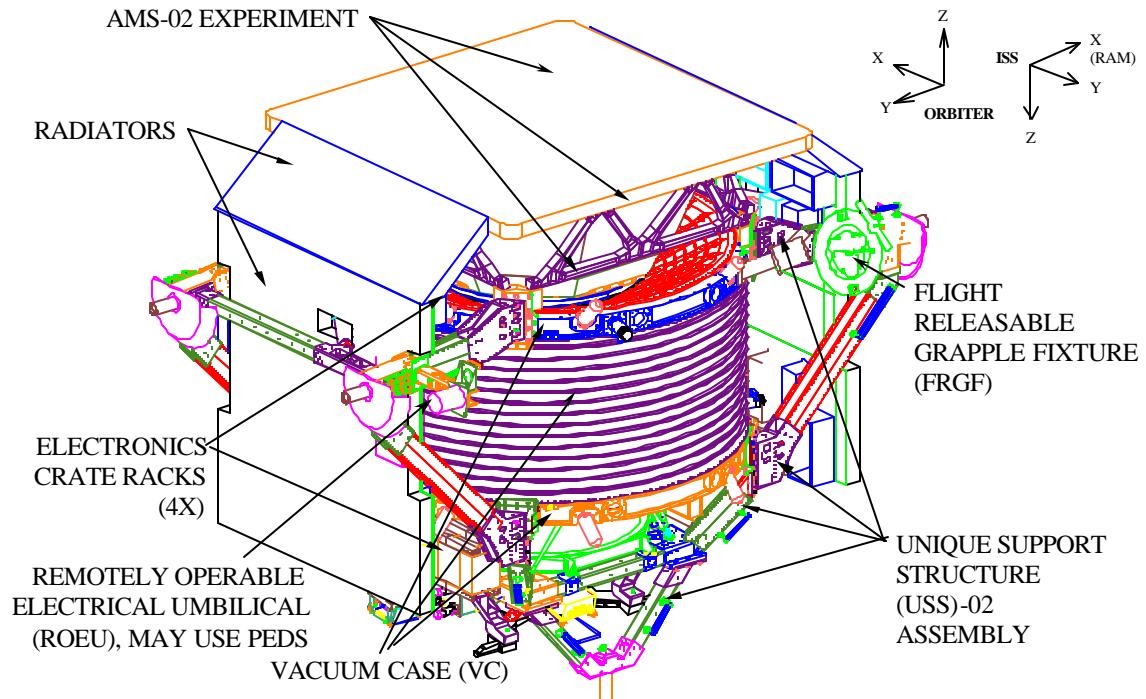


Figure 4.1.3-1 AMS Payload Assembly (1 of 4)

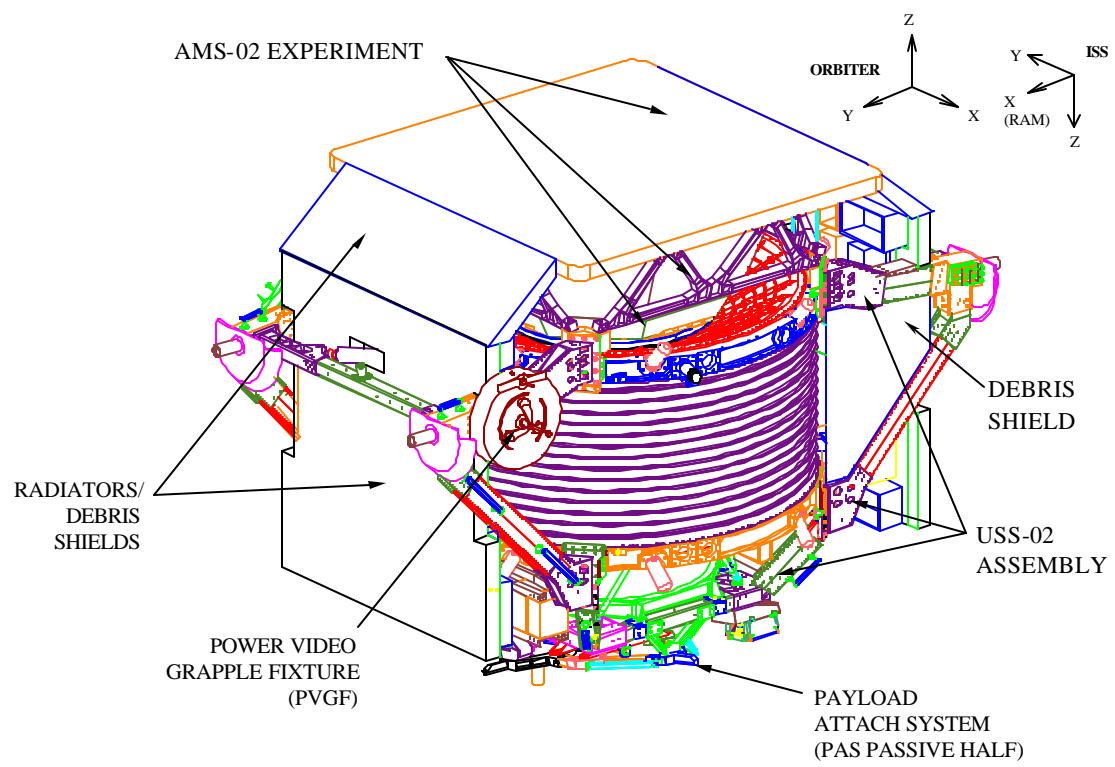


Figure 4.1.3-1 AMS Payload Assembly (2 of 4)

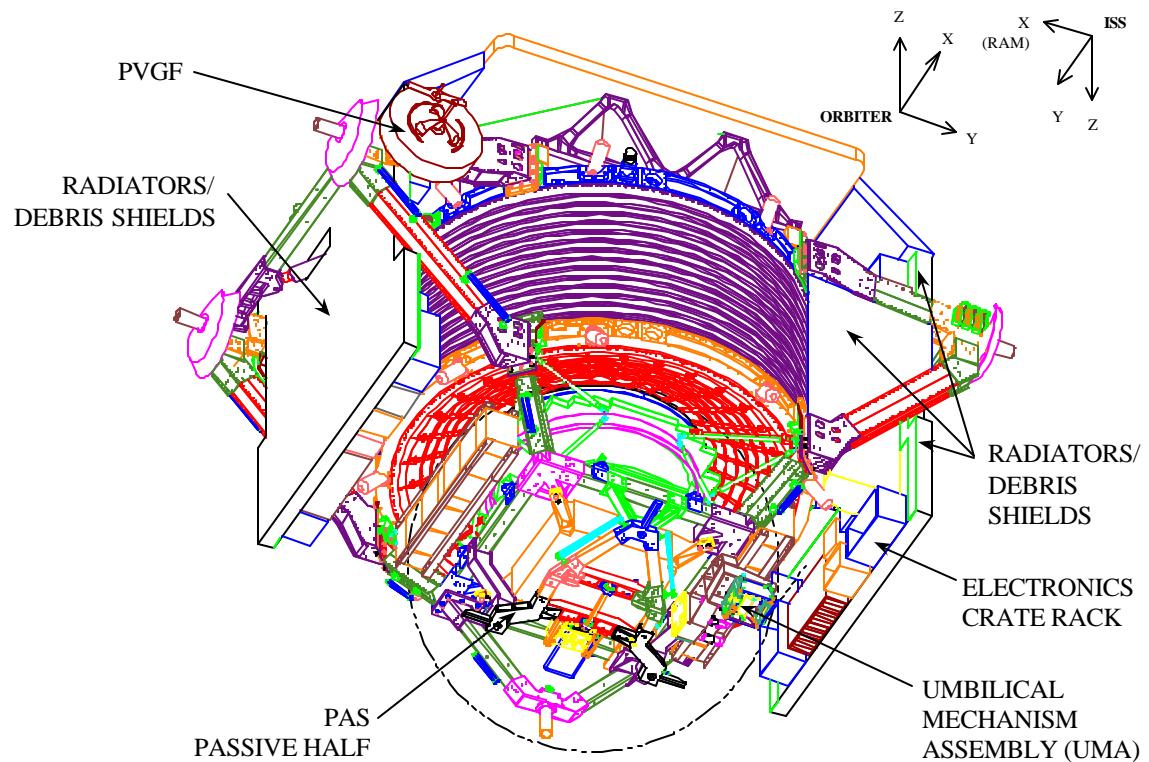


Figure 4.1.3-1 AMS Payload Assembly (3 of 4)

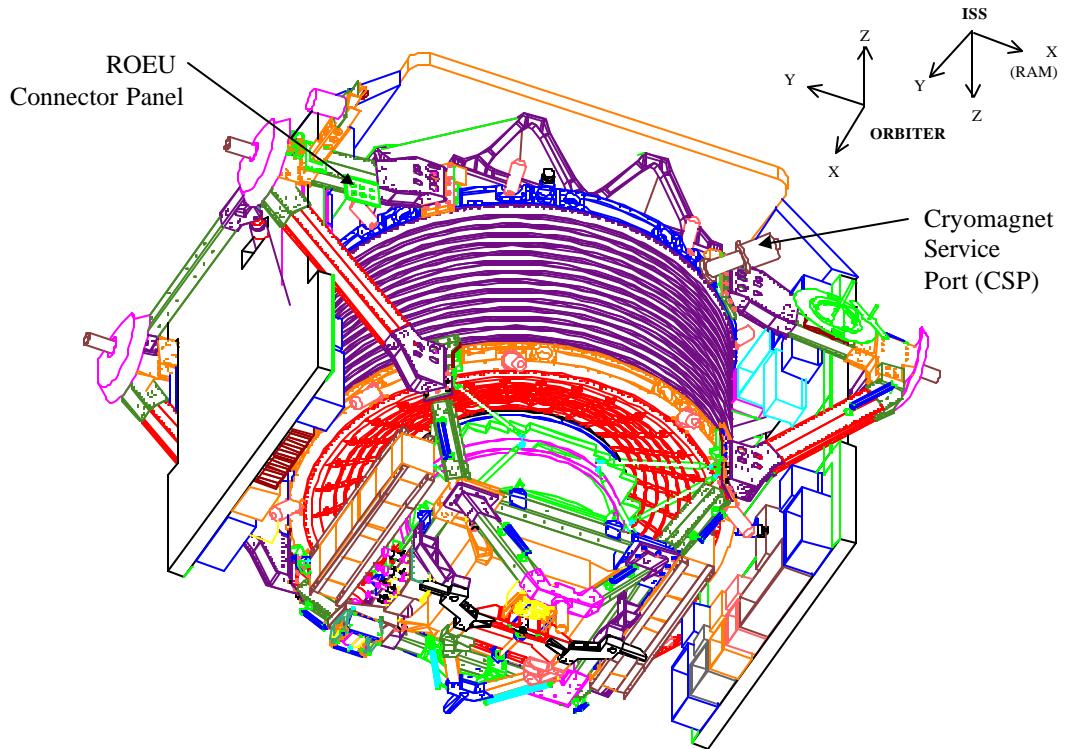


Figure 4.1.3-1 AMS Payload Assembly (4 of 4)

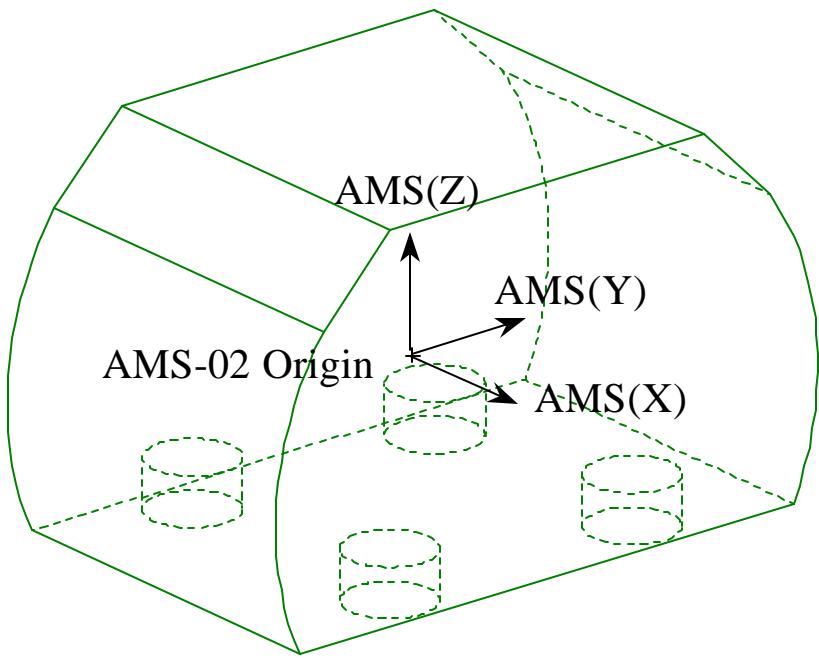


Figure 4.1.3-2 AMS Payload Upper Envelope (1 of 2)

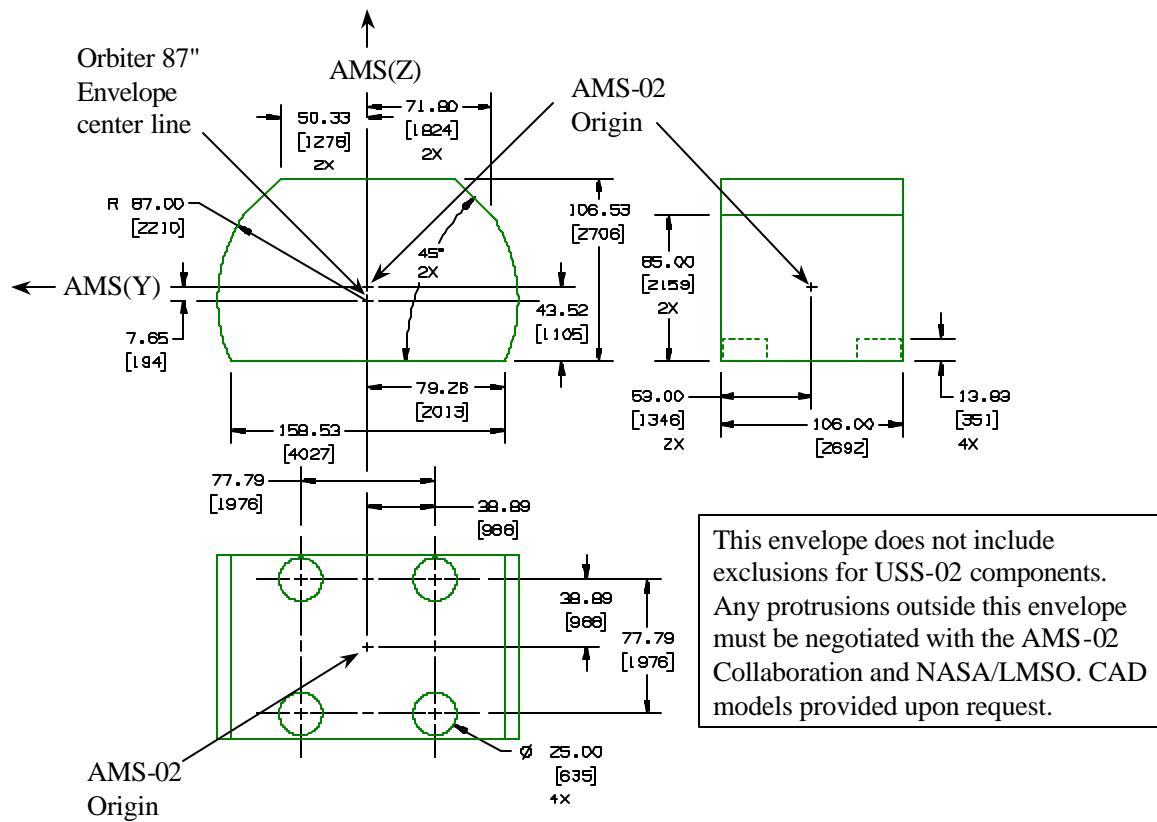


Figure 4.1.3-2 AMS Payload Upper Envelope (2 of 2)

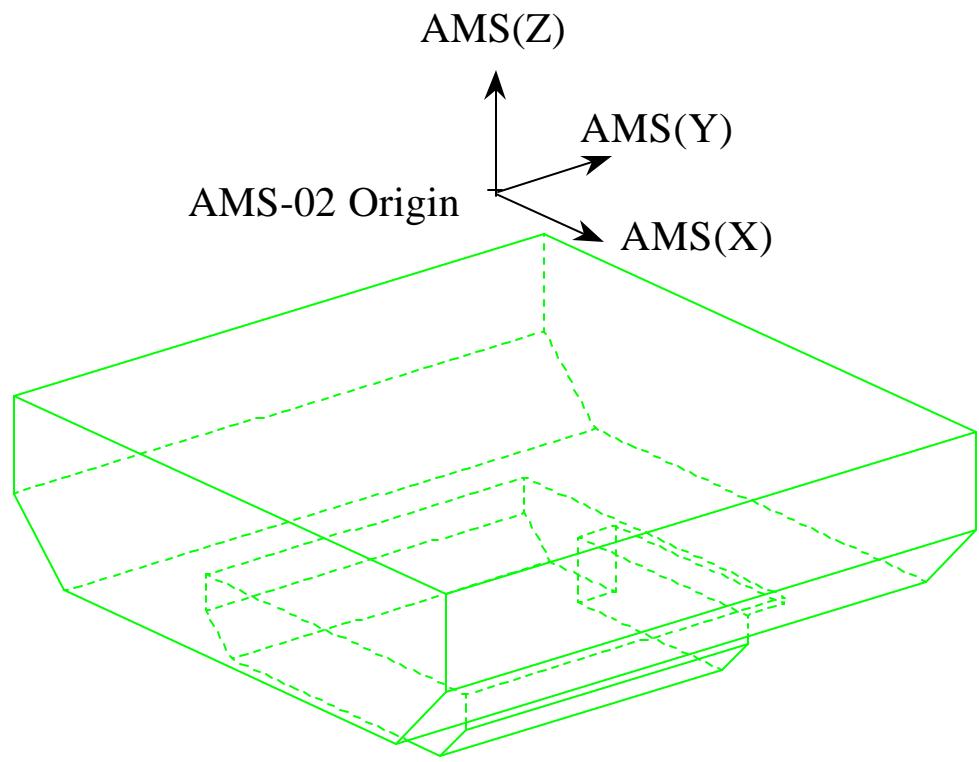


Figure 4.1.3-3 AMS Payload Lower Envelope (1 of 2)

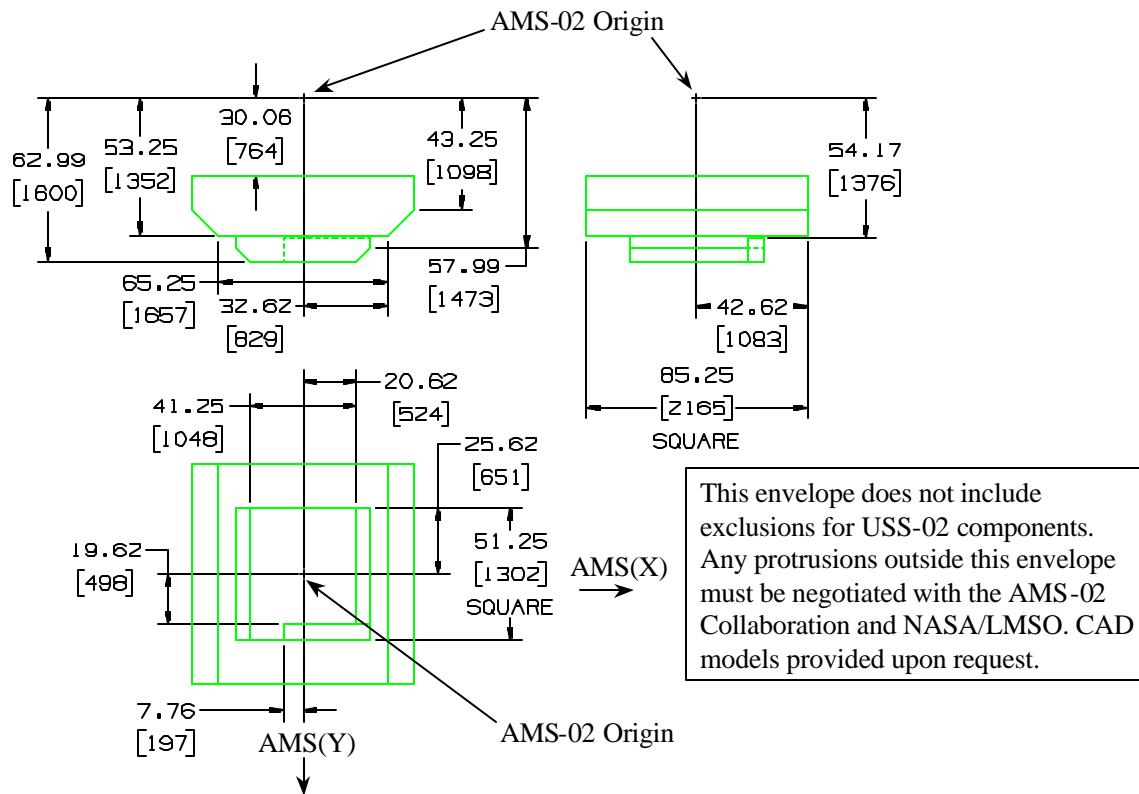


Figure 4.1.3-3 AMS Payload Lower Envelope (2 of 2)

4.1.4 Center of Gravity

The center of gravity of the AMS-02 experiment shall be in accordance with Figure 4.1.4-1.

Figure 4.1.4-1 Center of Gravity (TBD)

4.1.5 Field of View

The AMS-02 field of view shall be defined by a 48 degree half cone angle from the Z-axis, originating at X_{ams}=0, Y_{ams}=0, Z_{ams}=0.

4.1.6 Structural Interface

The main assembly structural interface shall be in accordance with Section 4.1.6.1

4.1.6.1 AMS Experiment To Interface Hardware Interfaces

A. Cryomagnet System to Vacuum Case (VC)

The Cryomagnet System to the Vacuum Case interface is called out in JSC - 29202
“AMS – 02 Experiment/Vacuum Case PIH Interfaces”

B. Cryomagnet System to Unique Support Structure – 02 (USS-02)

The Cryomagnet system will have a pneumatic valve helium tank that will be mounted somewhere on the USS-02 using existing mounting holes. It will most likely be moved inside the TRD Gas Supply Box. This system is currently TBD. The system will be used to operate pneumatic valves that are part of the overall cryogenic system. The valves will be located inside the vacuum case, but the warm pneumatic valve helium supply tank will be mounted to the USS-02. A bundle of plumbing lines will be routed from the pneumatic valve helium supply tank along the ring of the Vacuum Case, through a plumbing port on the Vacuum Case Ring into the vacuum space where it will be connected to the various pneumatic valves.

1. Warm Pneumatic Valve Helium Supply Tank

The pneumatic valve helium supply tank will be built to the structural verification requirements defined in JSC-28972. The current design is TBD by ETH/Space Cryomagnetics Ltd. (SCL).

Figure 4.1.6.1-1 Warm Pneumatic Valve Helium Supply Tank (TBD)

2. Warm Pneumatic Valve Helium Supply Tank Plumbing

Plumbing lines from the warm pneumatic valve helium supply tank will be routed through the vacuum case to the pneumatic valves that are part of the cryogenic

system. This plumbing and routing are currently **TBD**. All mounting to the USS-02 shall use existing mounting holes.

Figure 4.1.6.1-2 Warm Pneumatic Valve Helium Supply Tank Plumbing (TBD)

C. Experiment Interfaces to Vacuum Case

The Experiment Interfaces to the Vacuum Case are called out in JSC - 29202 “AMS – 02 Experiment/Vacuum Case PIH Interfaces”

D. Experiment Component Interfaces to USS-02

Most of the experiment components and the Vacuum Case mount to the USS-02. Figures 4.1.6.1-3, 4.1.6.1-4, 4.1.6.1-5, and 4.1.6.1-6 show the USS-02, the overall payload configuration and experiment interfaces.

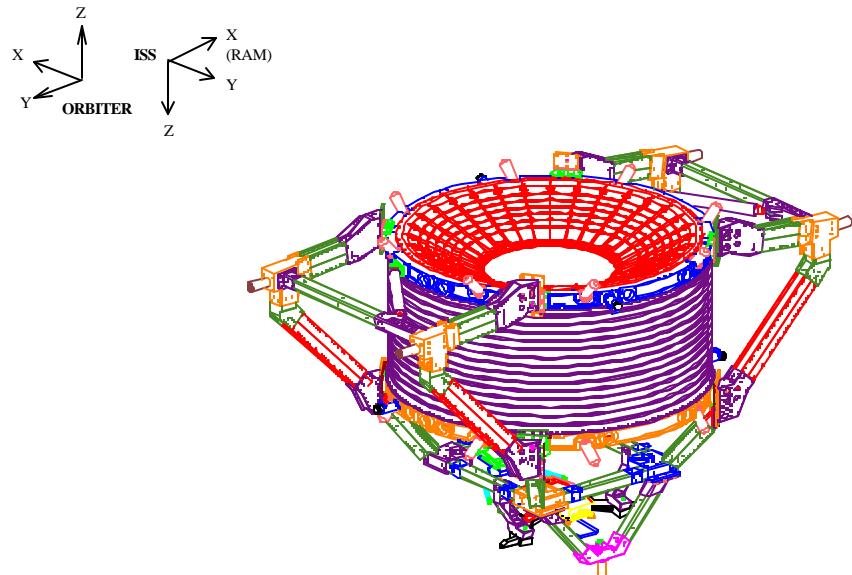


Figure 4.1.6.1-3 Unique Support Structure – 02 (1 of 10)

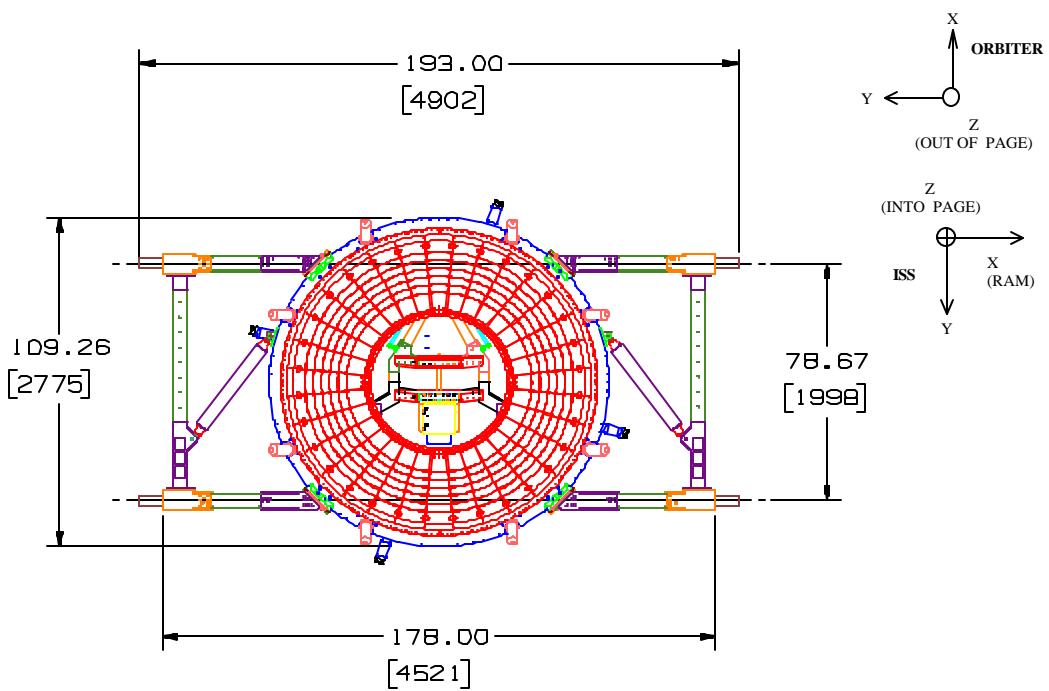


Figure 4.1.6.1-3 USS-02 (2 of 10)

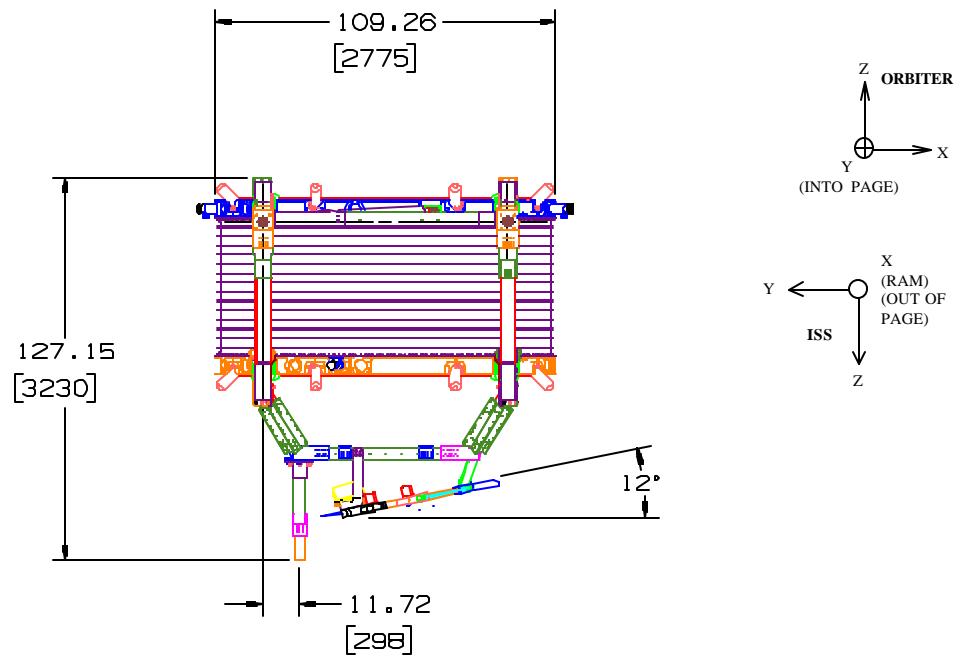


Figure 4.1.6.1-3 USS-02 (3 of 10)

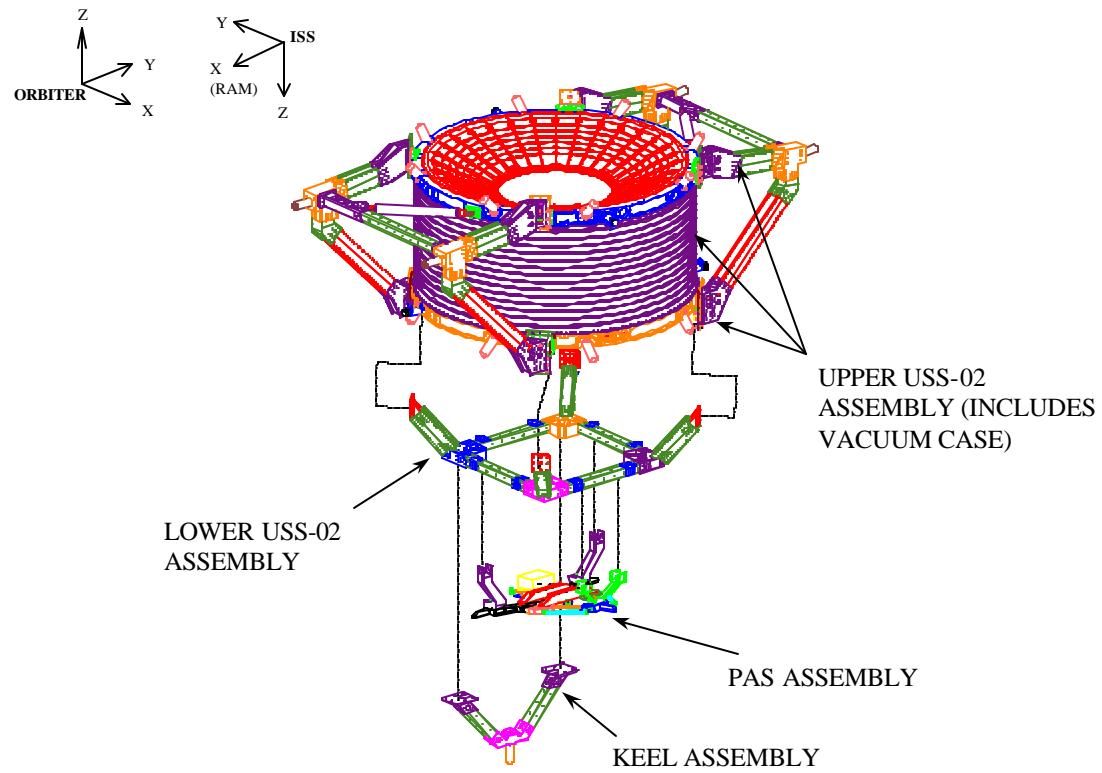


Figure 4.1.6.1-3 USS-02 (4 of 10)

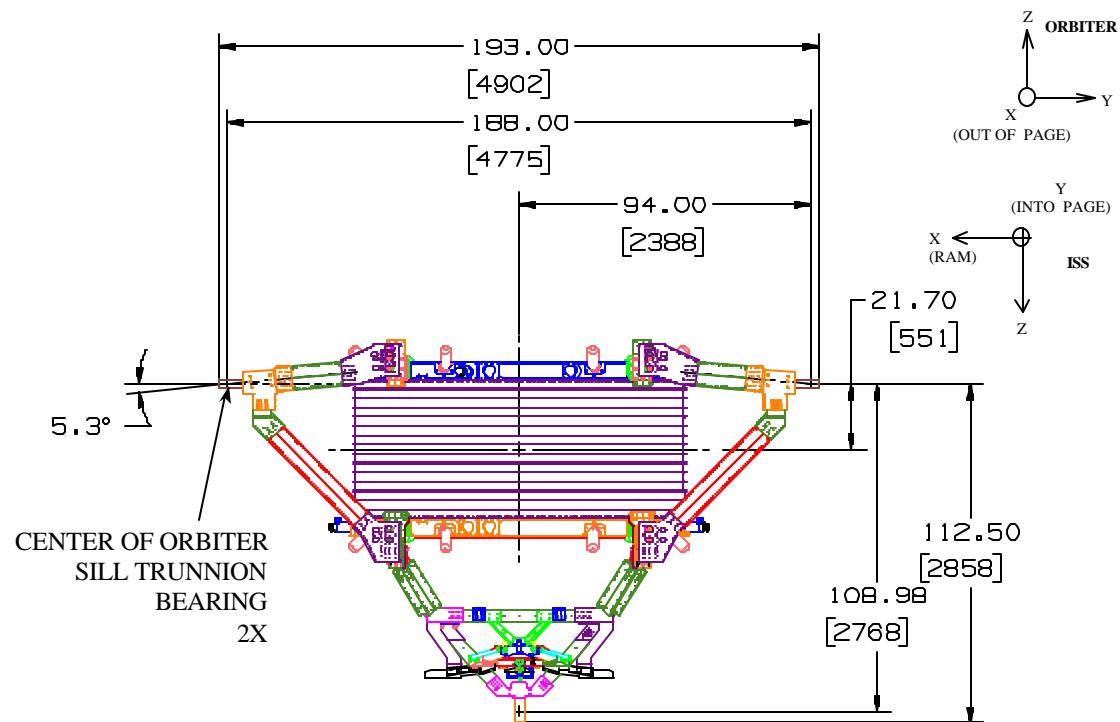


Figure 4.1.6.1-3 USS-02 (5 of 10)

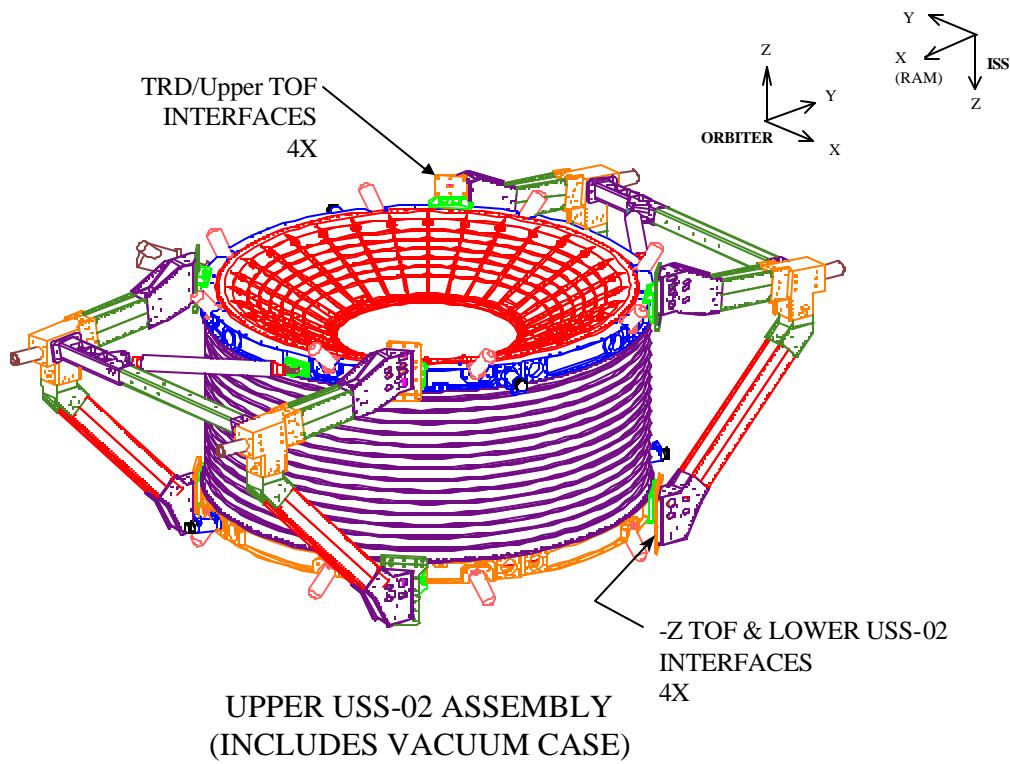


Figure 4.1.6.1-3 USS-02 (6 of 10)

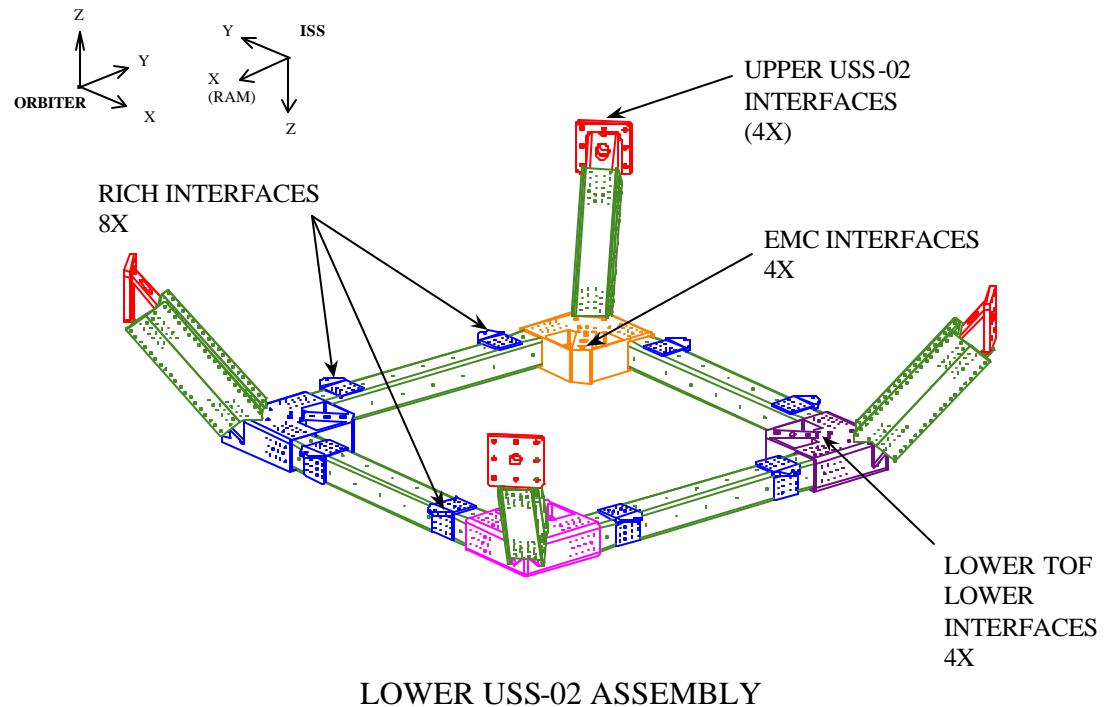
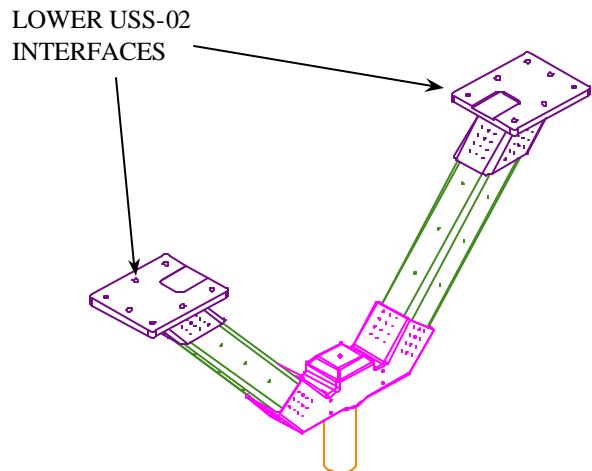


Figure 4.1.6.1-3 USS-02 (7 of 10)



KEEL ASSEMBLY

Figure 4.1.6.1-3 USS-02 (8 of 10)

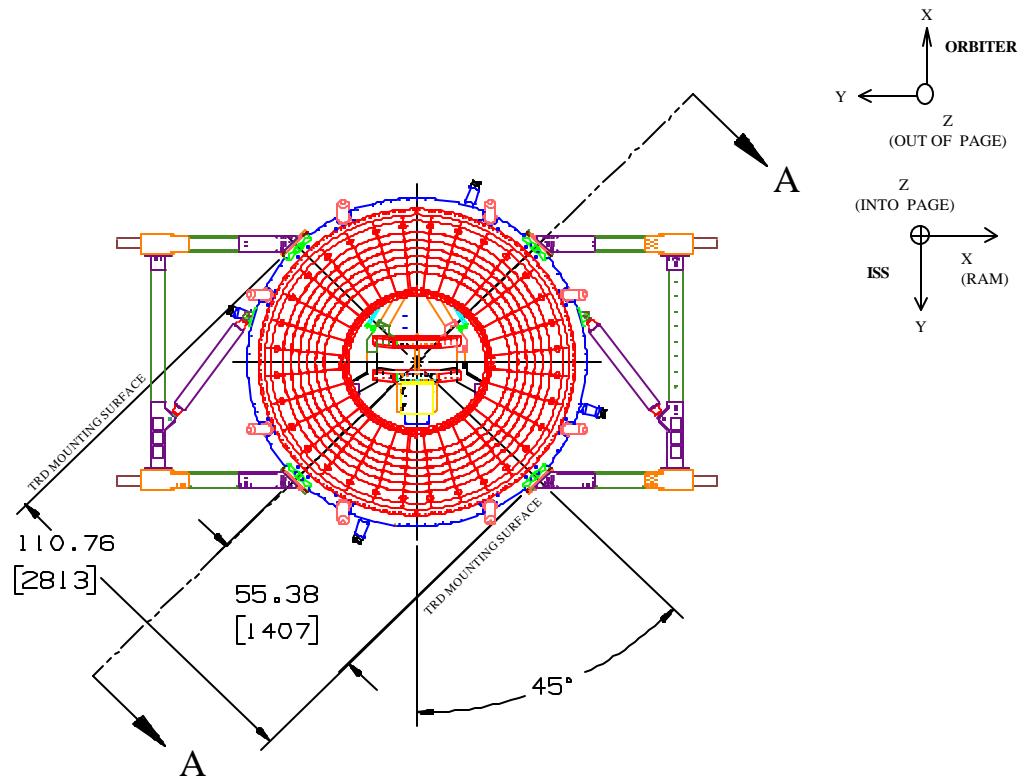
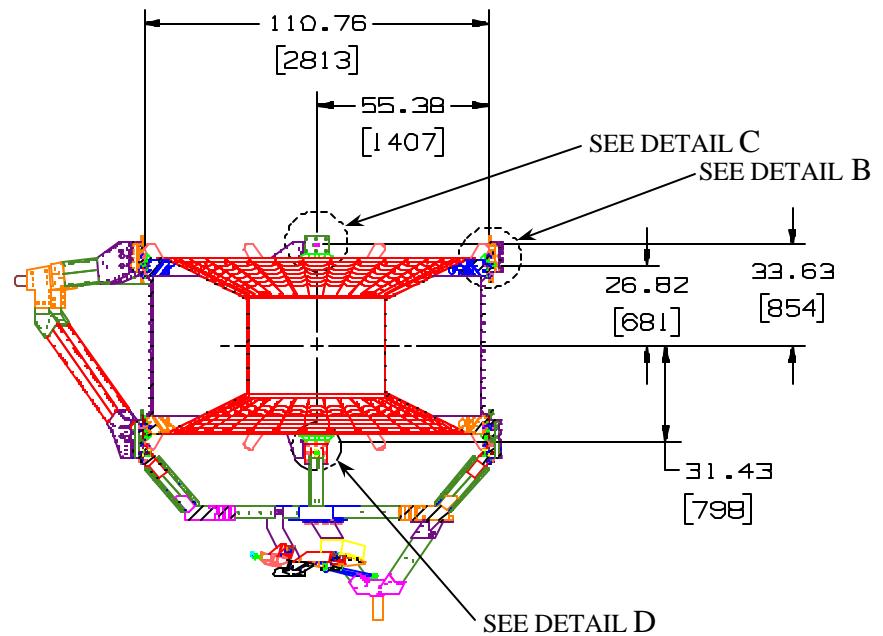


Figure 4.1.6.1-3 USS-02 (9 of 10)



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Figure 4.1.6.1-3 USS-02 (10 of 10)

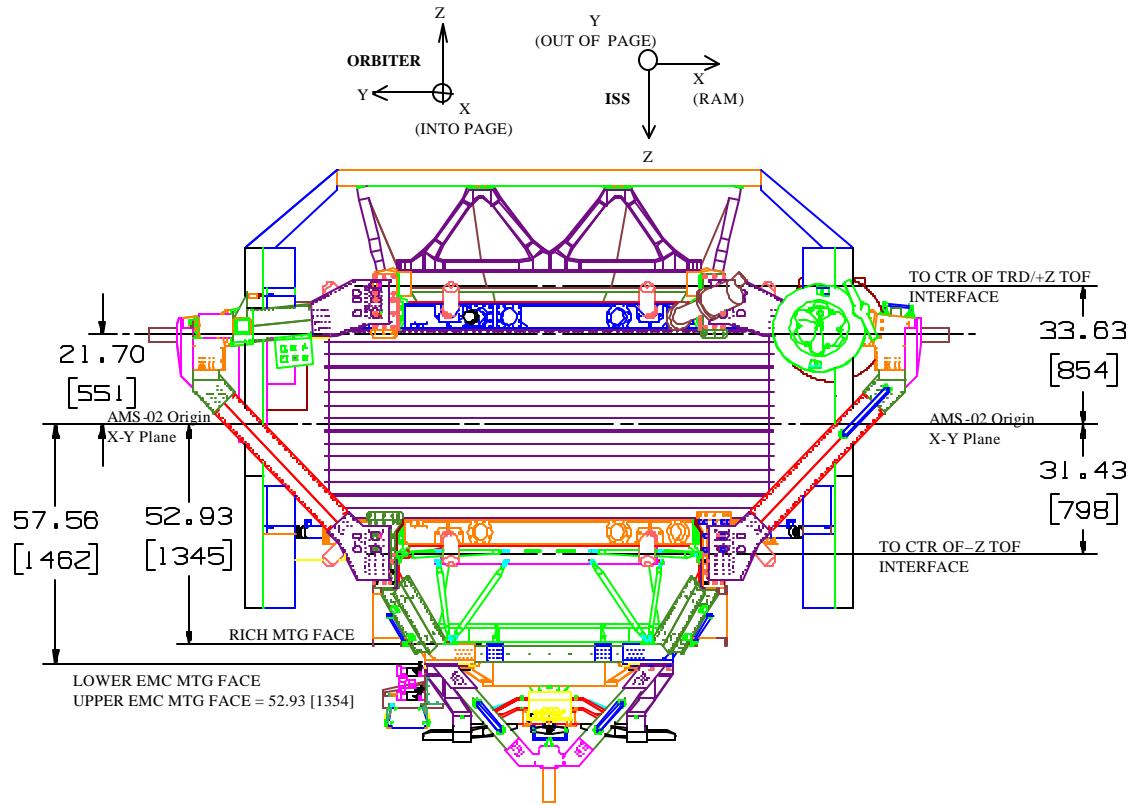


Figure 4.1.6.1-4 USS-02 Mounting Interface Heights

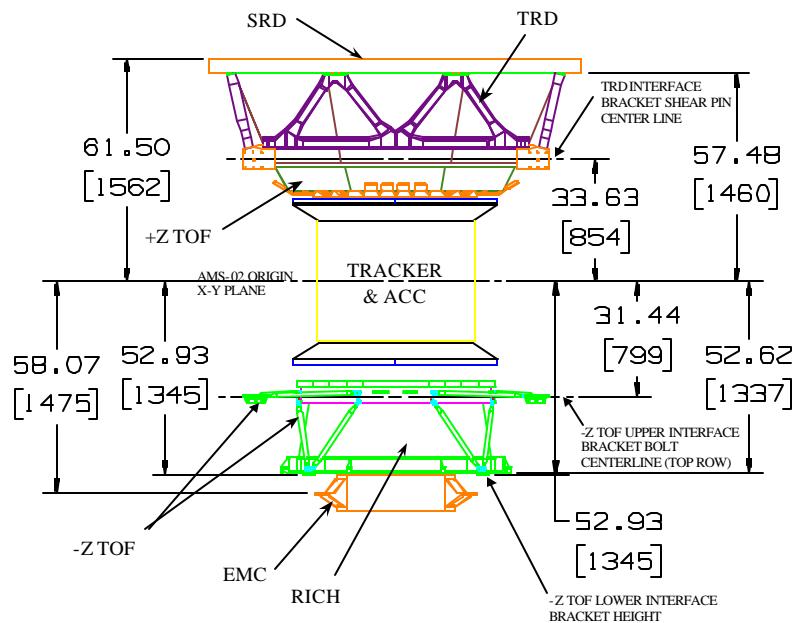


Figure 4.1.6.1-5 AMS Experiment Interface Heights

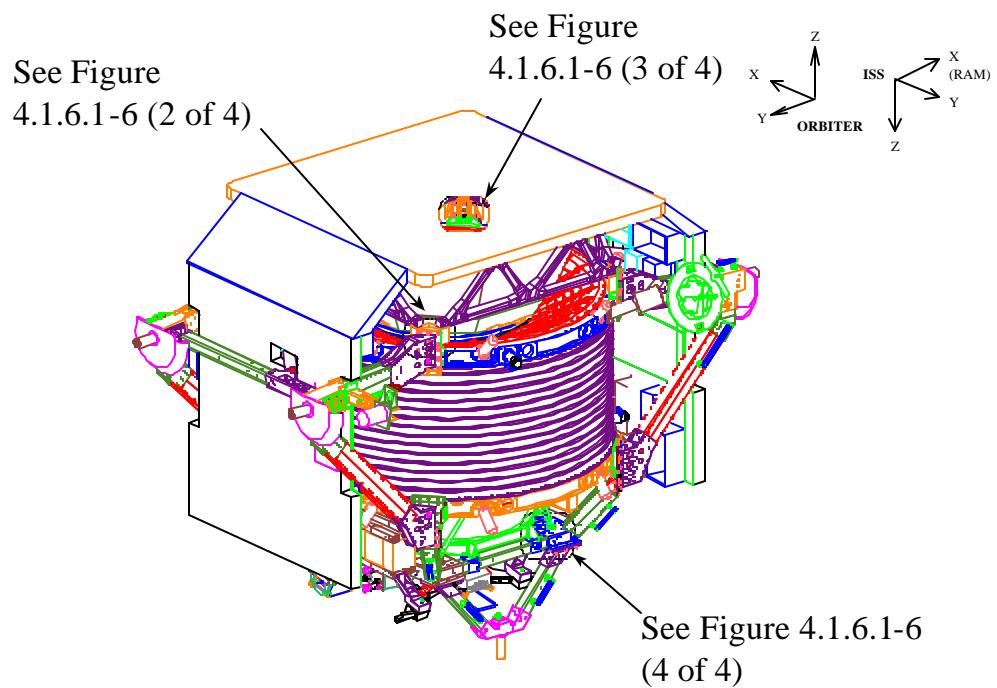


Figure 4.1.6.1-6 Experiment Mounting Configuration (1 of 4)

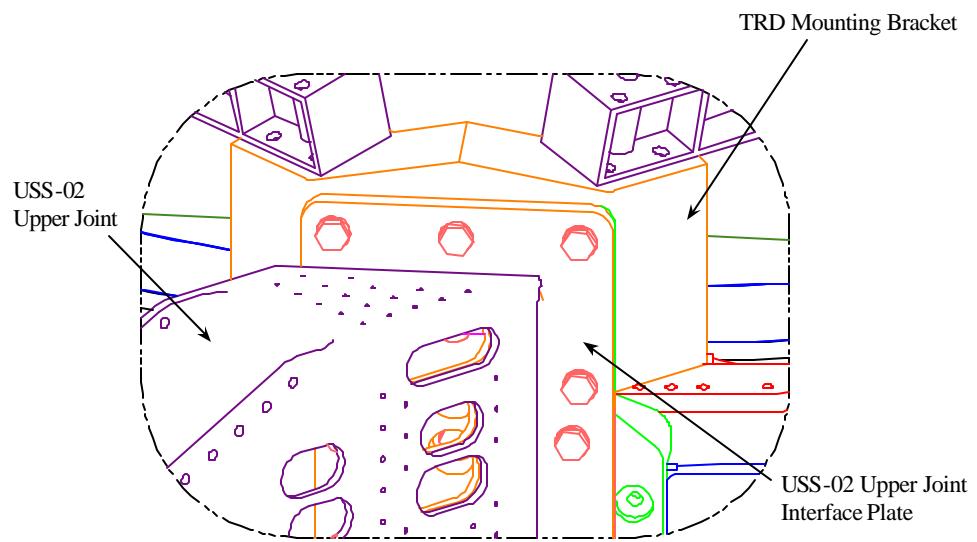


Figure 4.1.6.1-6 Experiment Mounting Configuration (2 of 4)

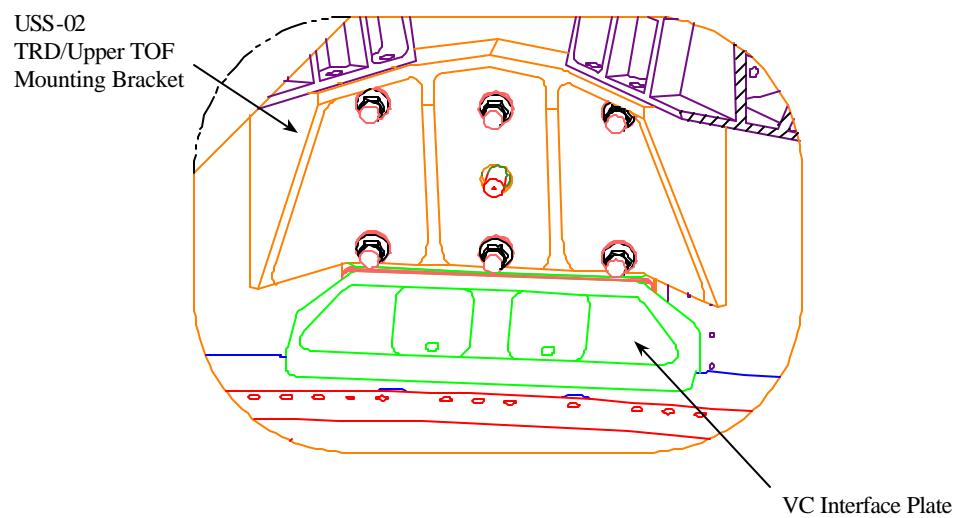


Figure 4.1.6.1-6 Experiment Mounting Configuration (3 of 4)

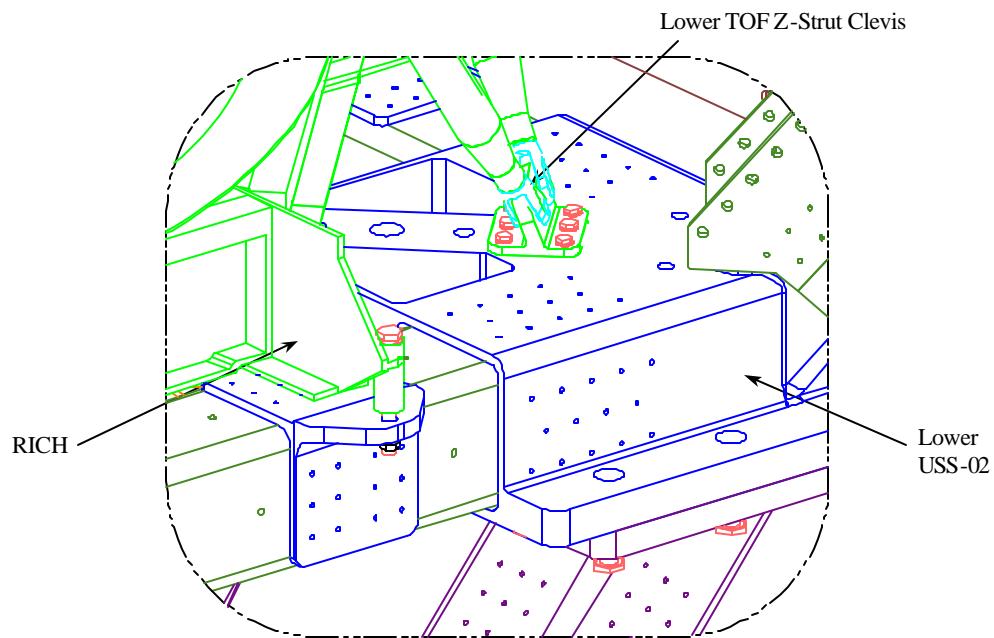


Figure 4.1.6.1-6 Experiment Mounting Configuration (4 of 4)

1. Transition Radiation Detector (TRD) & Upper Time of Flight (TOF)

The TRD and Upper TOF mount to the USS-02 as shown in Figure 4.1.6.1-7.

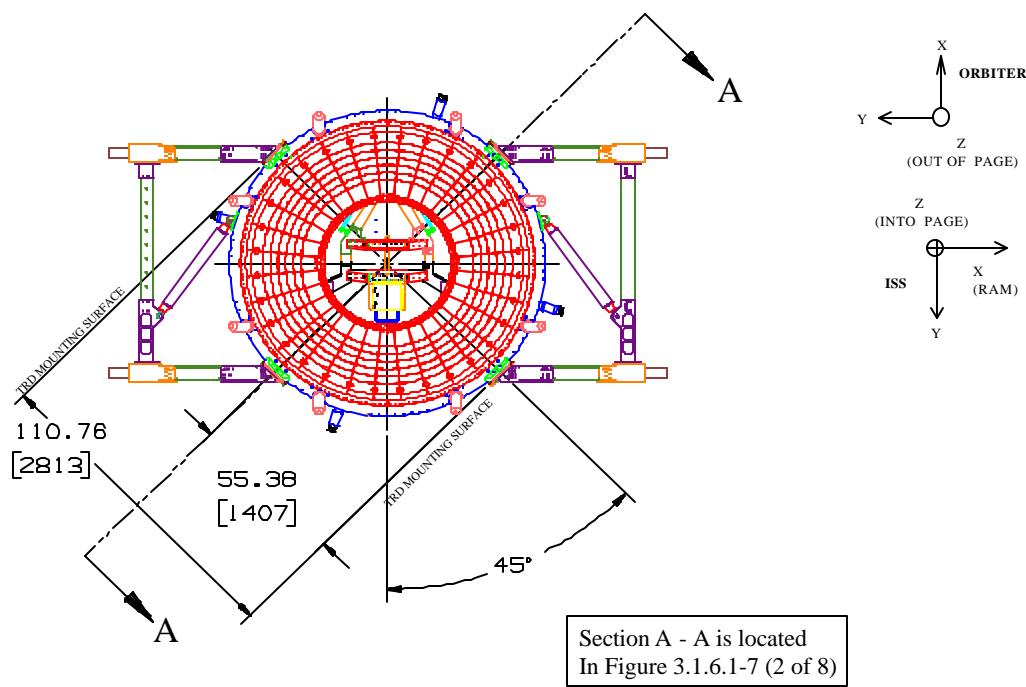


Figure 4.1.6.1-7 TRD & Upper TOF to USS-02 Mounting Locations (1 of 8)

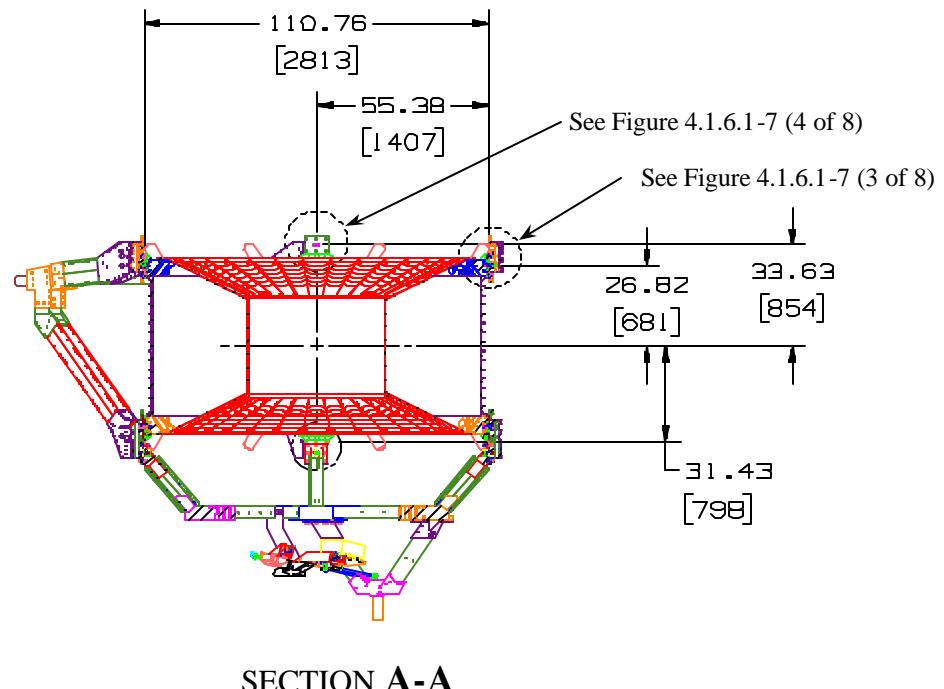


Figure 4.1.6.1-7 TRD & Upper TOF to USS-02 Mounting Locations (2 of 8)

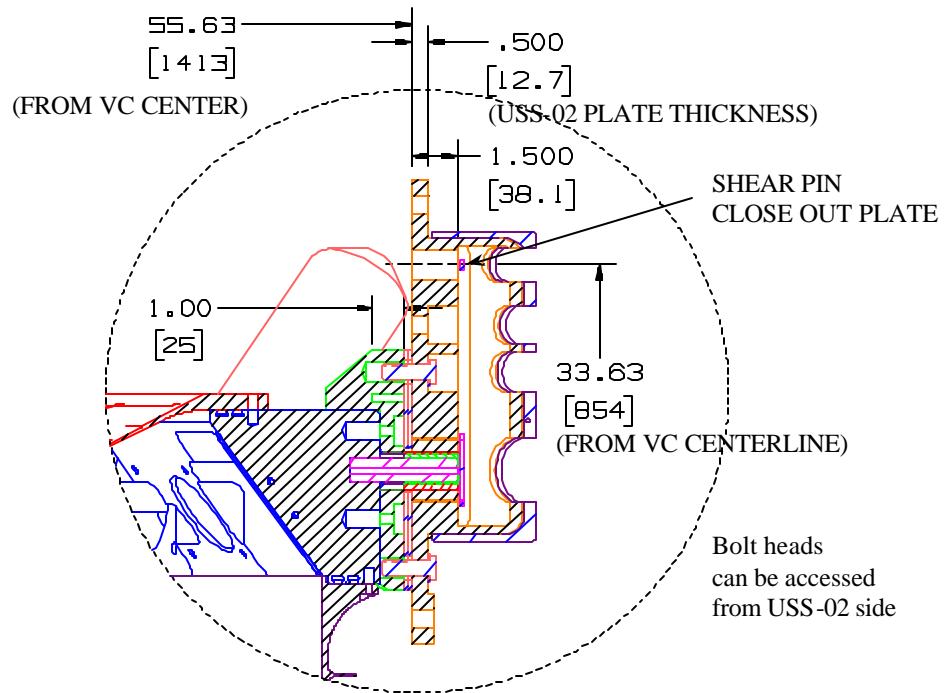


Figure 4.1.6.1-7 TRD & Upper TOF to USS-02 Mounting Locations (3 of 8)

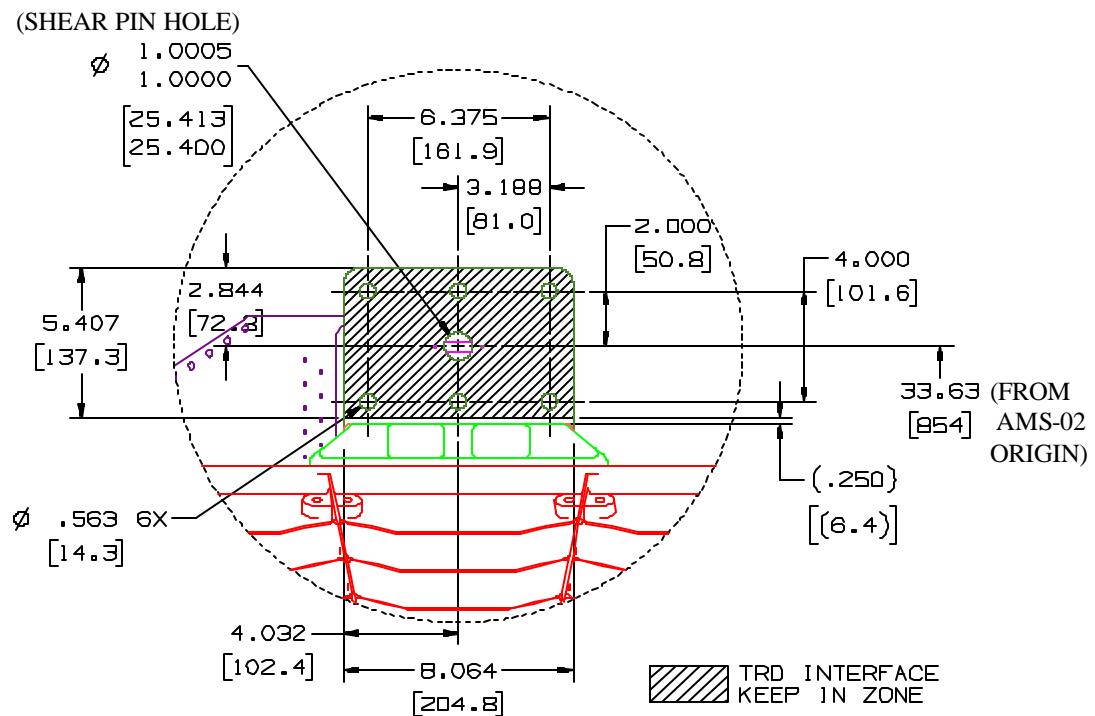


Figure 4.1.6.1-7 TRD & Upper TOF to USS-02 Mounting Locations (4 of 8)

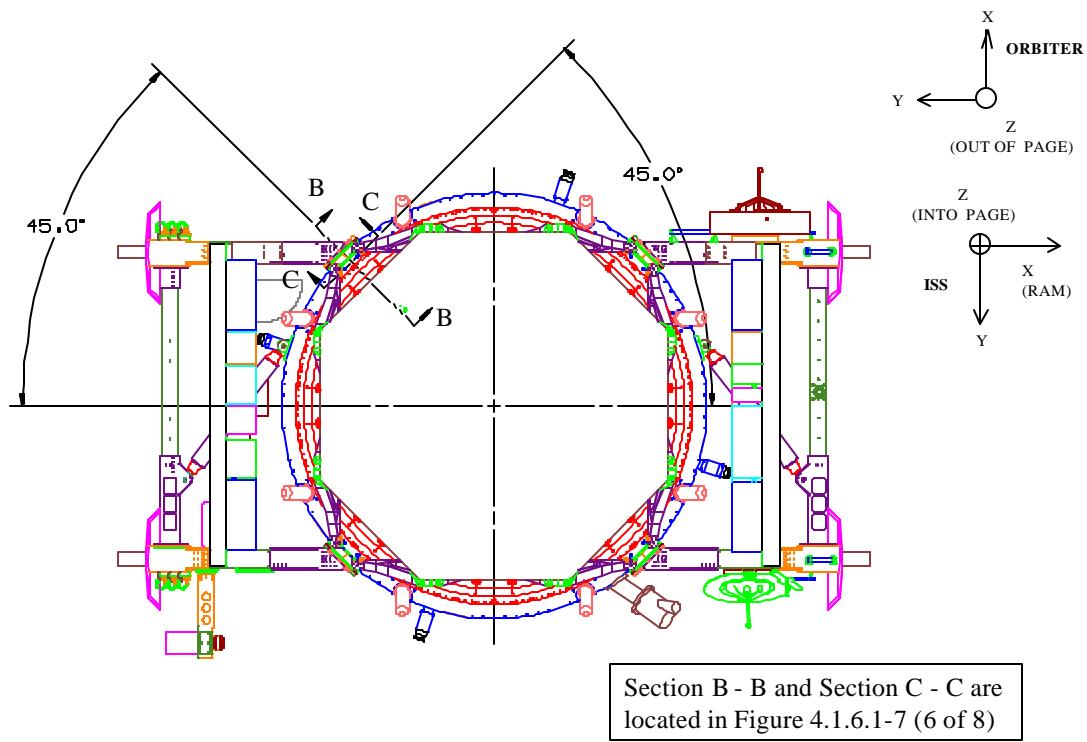


Figure 4.1.6.1-7 TRD & Upper TOF to USS-02 Mounting Locations (5 of 8)

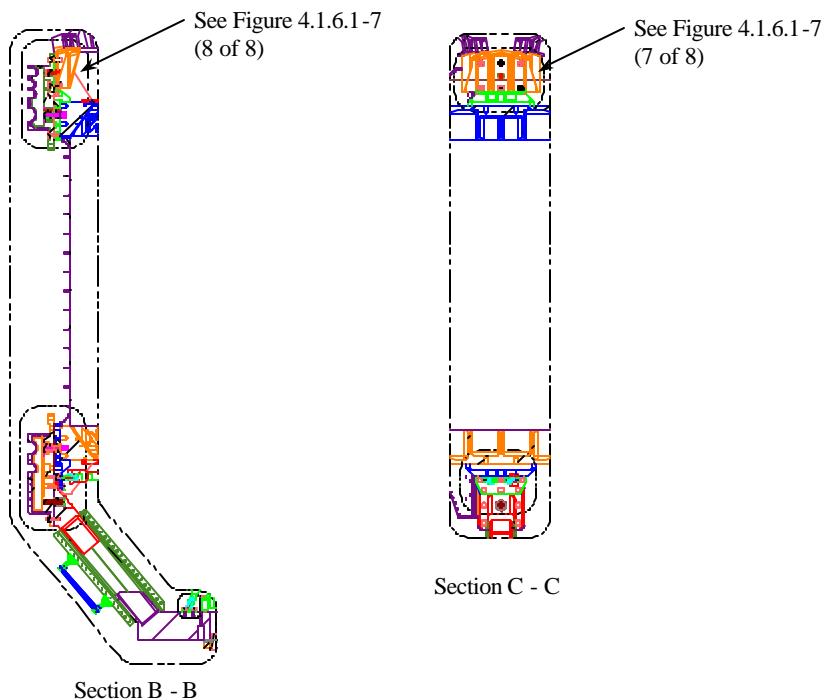


Figure 4.1.6.1-7 TRD & Upper TOF to USS-02 Mounting Locations (6 of 8)

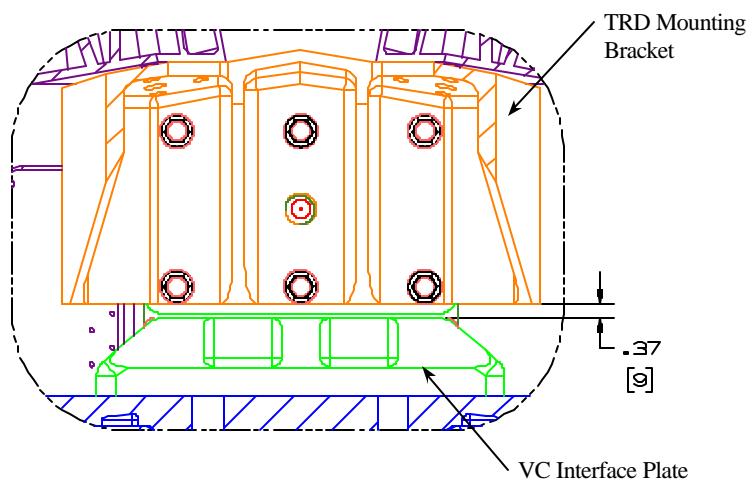


Figure 4.1.6.1-7 TRD & Upper TOF to USS-02 Mounting Locations (7 of 8)

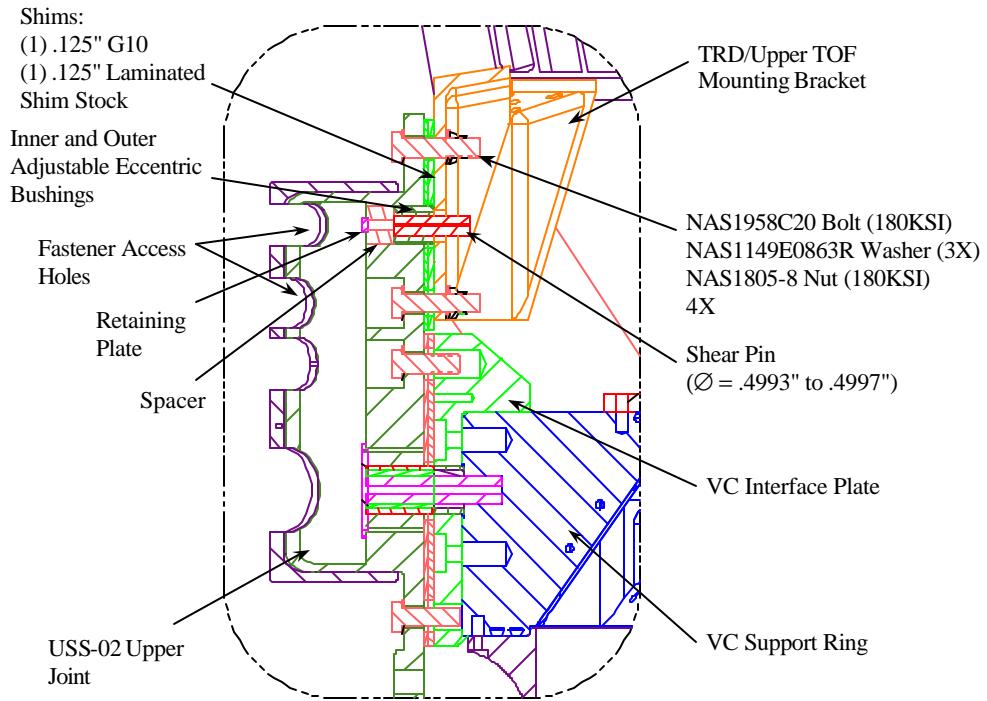


Figure 4.1.6.1-7 TRD & Upper TOF to USS-02 Mounting Locations (8 of 8)

2. TRD Gas Supply System

The TRD Gas Supply System will be mounted to the USS-02 using existing mounting holes on the ISS Wake side of the Vacuum Case. This will provide the best protection for this system from Orbital debris. The mounting scheme is currently **TBD**.

a. TRD Gas Supply Box

The TRD Gas Supply Box is currently **TBD BY ROBERT BECKER**.

Figure 4.1.6.1-8 TRD Gas Supply Box Interface (TBD)

B. TRD Gas Plumbing

The TRD Gas Plumbing is currently **TBD BY ROBERT BECKER.**

Figure 4.1.6.1-9 TRD Gas Plumbing Interface (TBD)

3. Lower TOF

The lower TOF mounts to the USS-02 below the lower VC interfaces. This interface is currently defined as shown in Figure 4.1.6.1-10, but is currently under review by the experiment team.

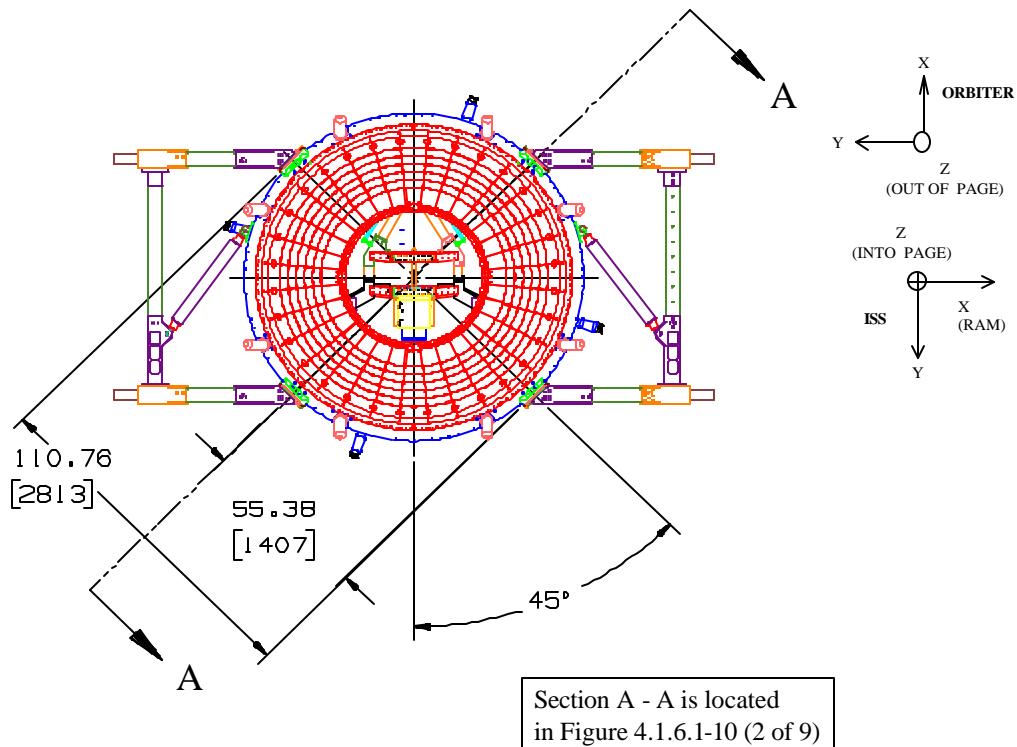
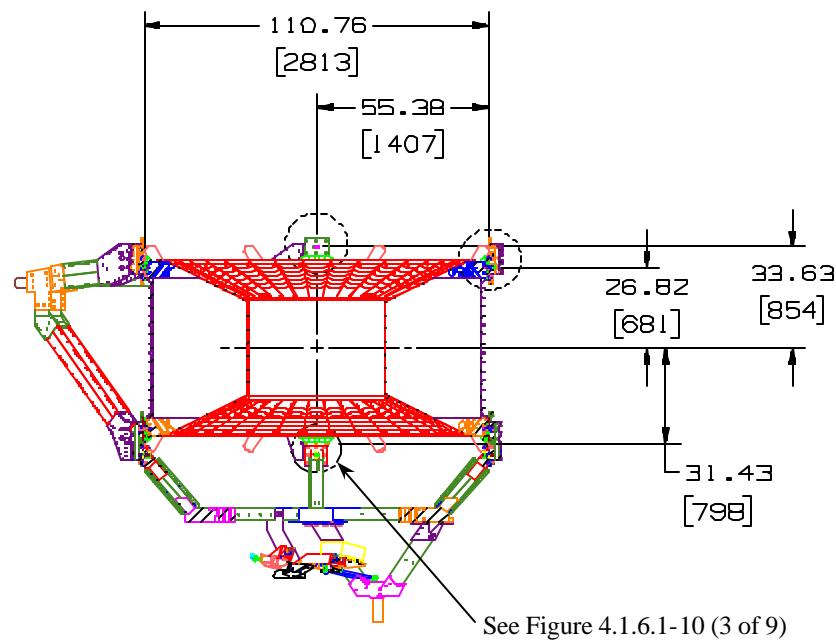


Figure 4.1.6.1-10 Lower TOF to USS-02 Mounting Locations (1 of 9)



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Figure 4.1.6.1-10 Lower TOF to USS-02 Mounting Locations (2 of 9)

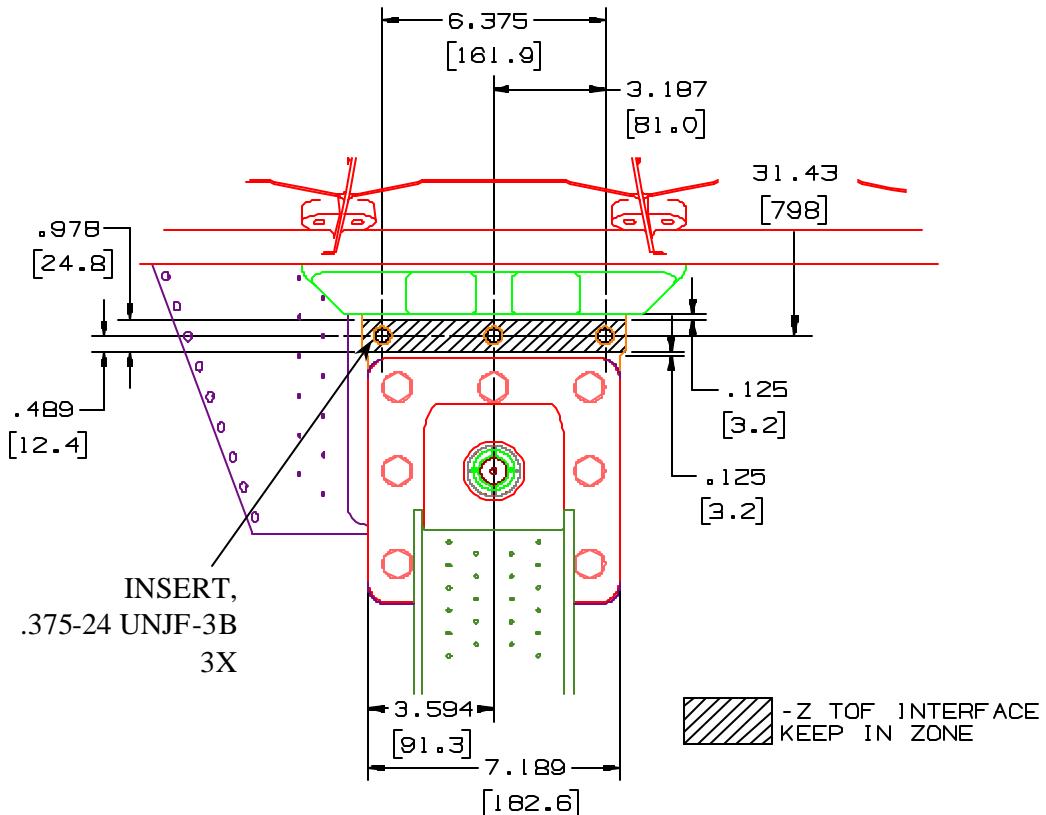
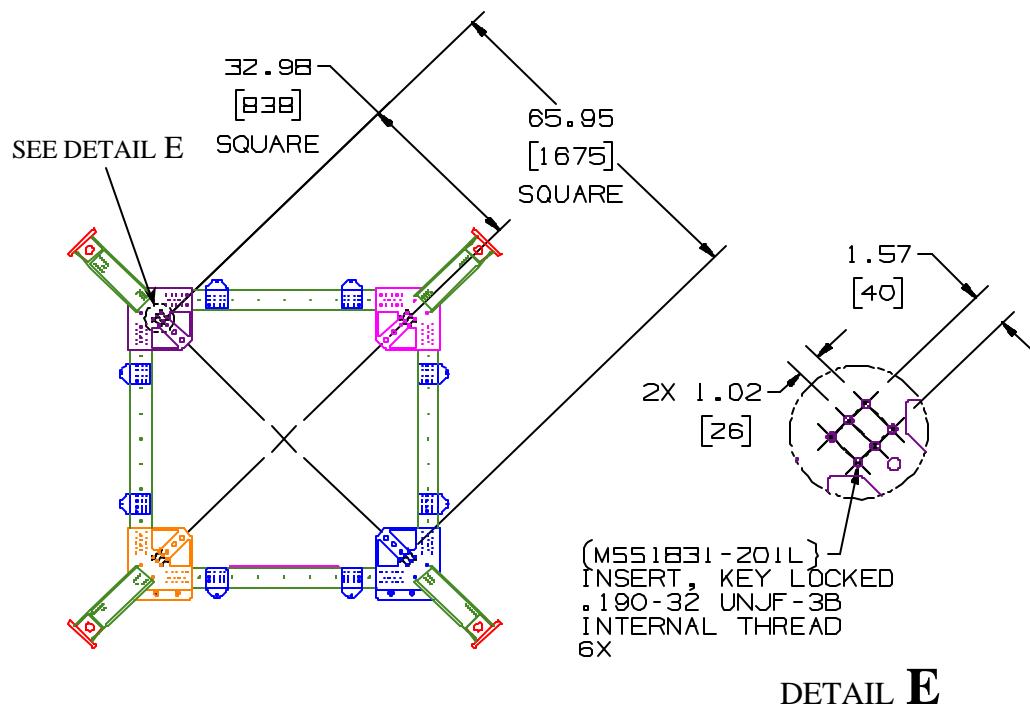


Figure 4.1.6.1-10 Lower TOF to USS-02 Mounting Locations (3 of 9)



DETAIL E

Figure 4.1.6.1-10 Lower TOF to USS-02 Mounting Locations (4 of 9)

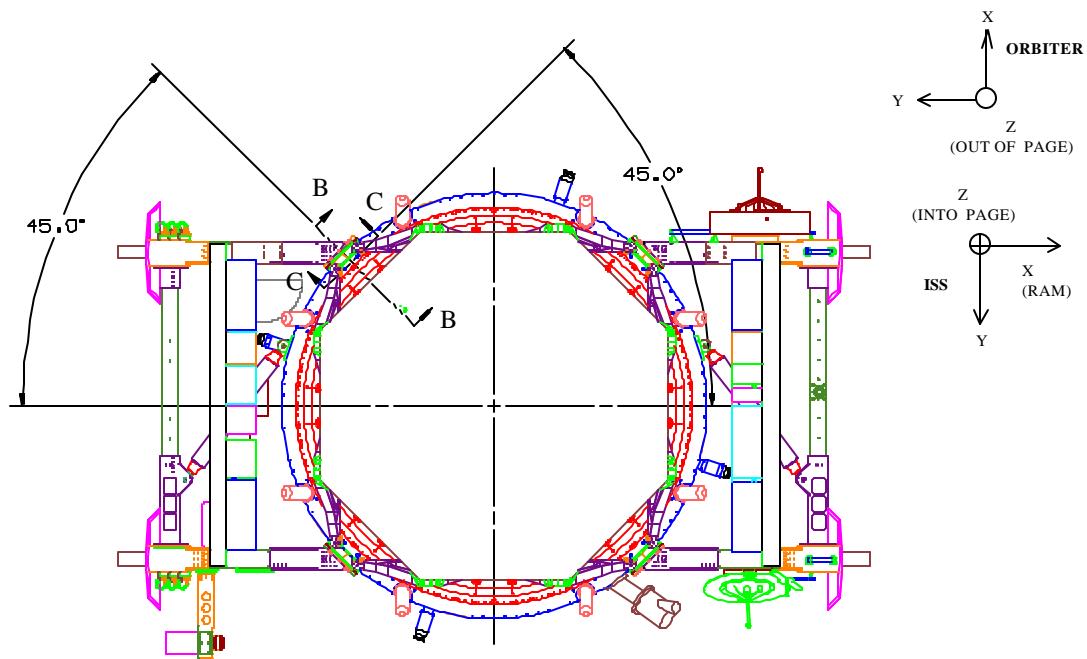


Figure 4.1.6.1-10 Lower TOF to USS-02 Mounting Locations (5 of 9)

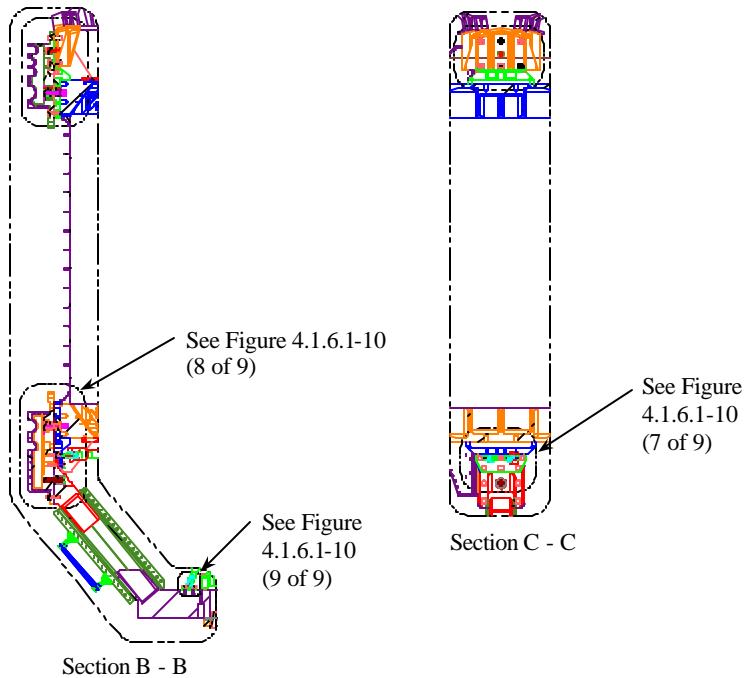
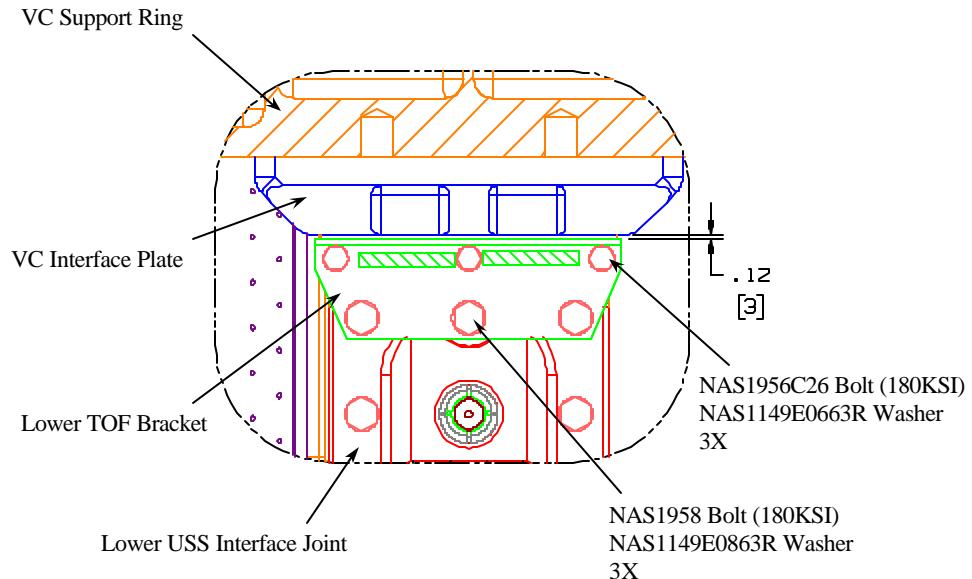
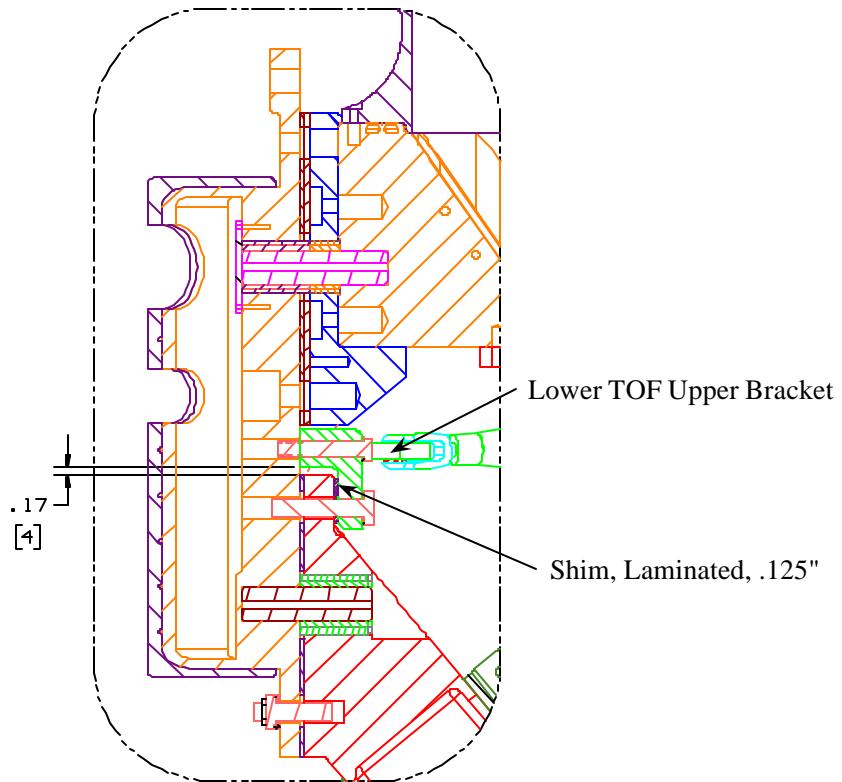


Figure 4.1.6.1-10 Lower TOF to USS-02 Mounting Locations (6 of 9)



THIS INTERFACE IS TBD PENDING CONFIRMATION WITH G. LAURENTI

Figure 4.1.6.1-10 Lower TOF to USS-02 Mounting Locations (7 of 9)



THIS INTERFACE IS TBD PENDING CONFIRMATION WITH G. LAURENTI

Figure 4.1.6.1-10 Lower TOF to USS-02 Mounting Locations (8 of 9)

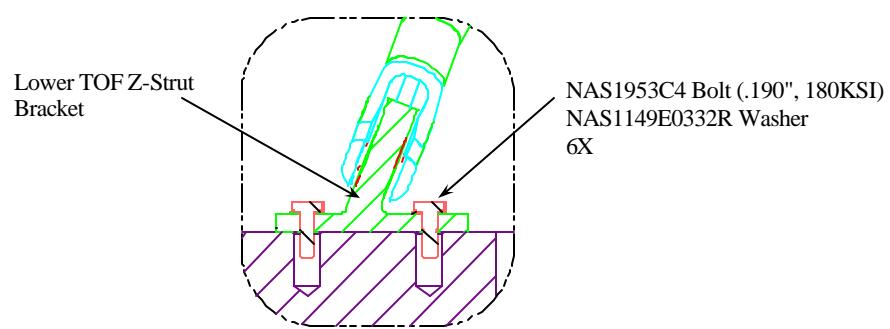


Figure 4.1.6.1-10 Lower TOF to USS-02 Mounting Locations (9 of 9)

4. Ring Imaging Cherenkov Counter (RICH)

The RICH interfaces to the lower USS-02 as shown in Figure 4.1.6.1-11.

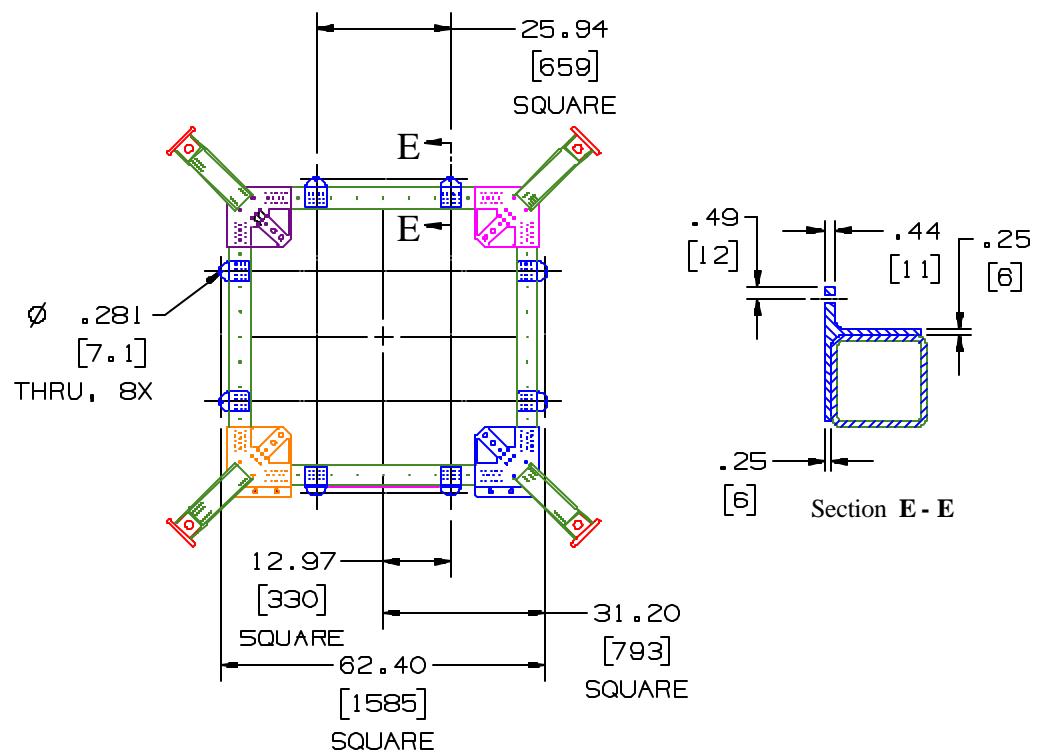


Figure 4.1.6.1-11 RICH to USS-02 Mounting Locations (1 of 3)

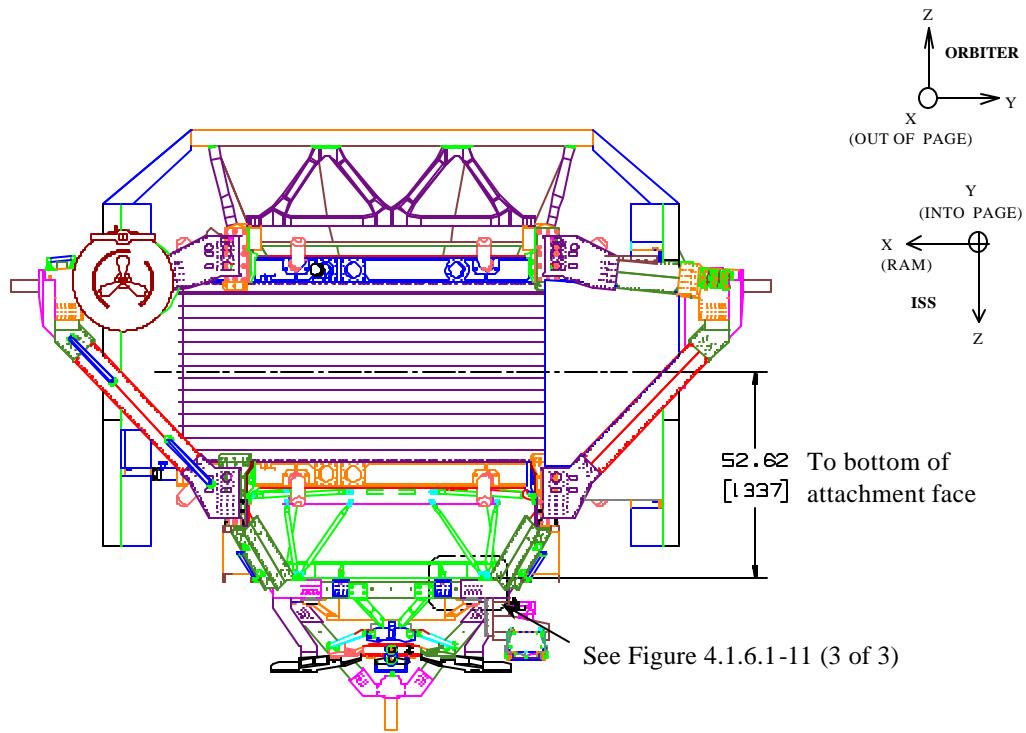


Figure 4.1.6.1-11 RICH to USS-02 Mounting Locations (2 of 3)

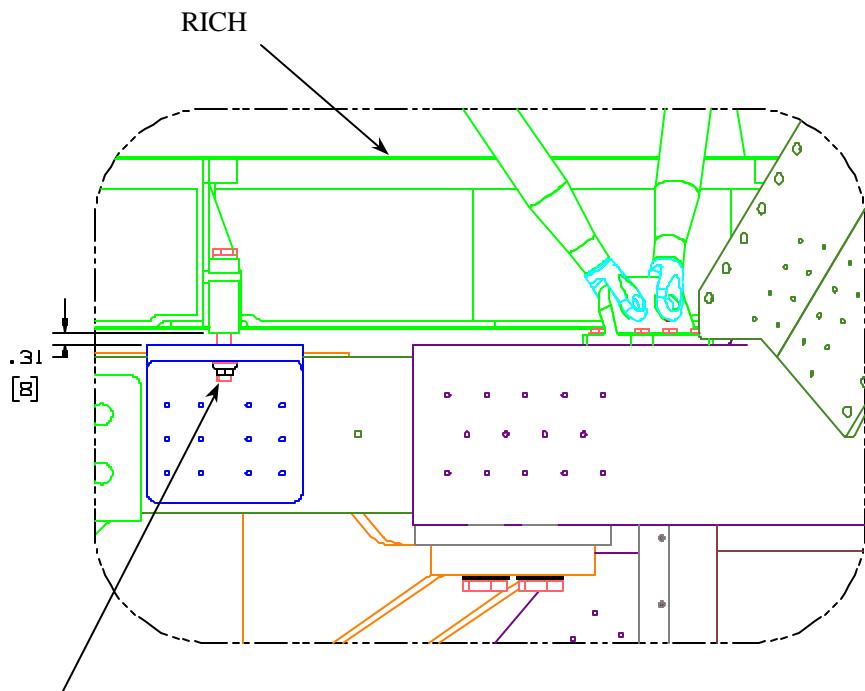


Figure 4.1.6.1-11 RICH to USS-02 Mounting Locations (3 of 3)

5. Electromagnetic Calorimeter (ECAL)

The ECAL mounts to the lower USS-02 as shown in Figure 4.1.6.1-12.

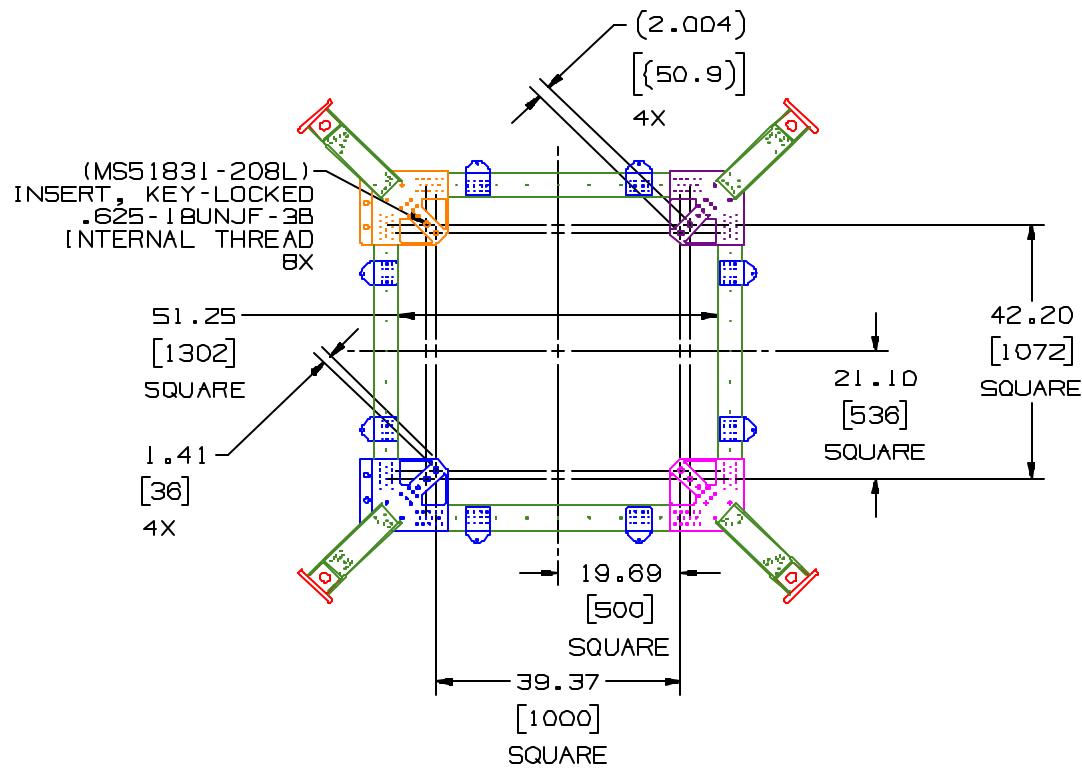


Figure 4.1.6.1-12 ECAL to USS-02 Mounting Locations (1 of 5)

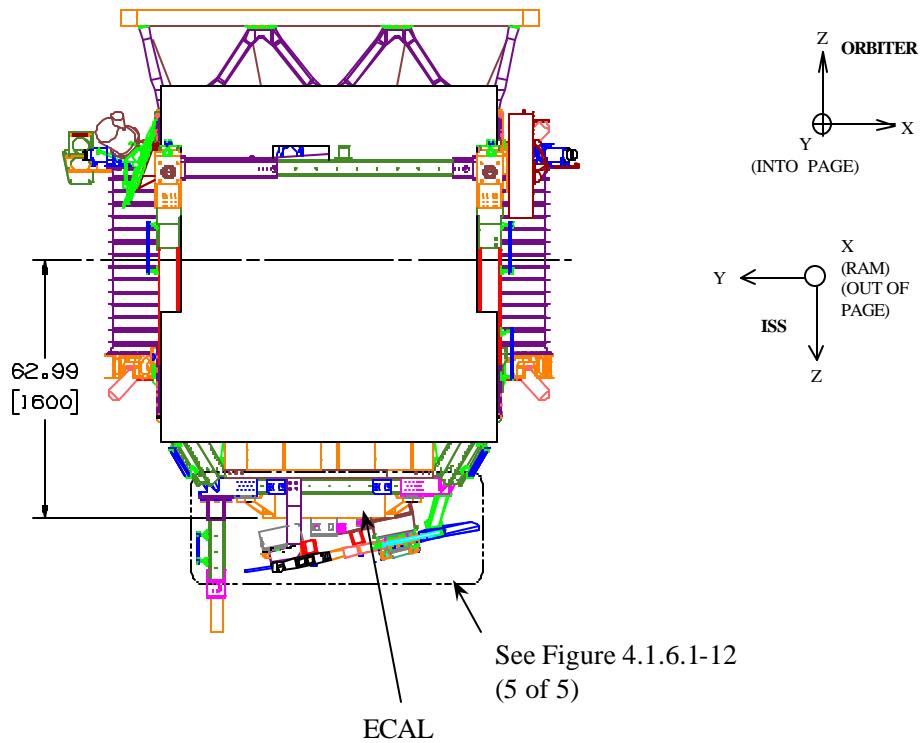


Figure 4.1.6.1-12 ECAL to USS-02 Mounting Locations (2 of 5)

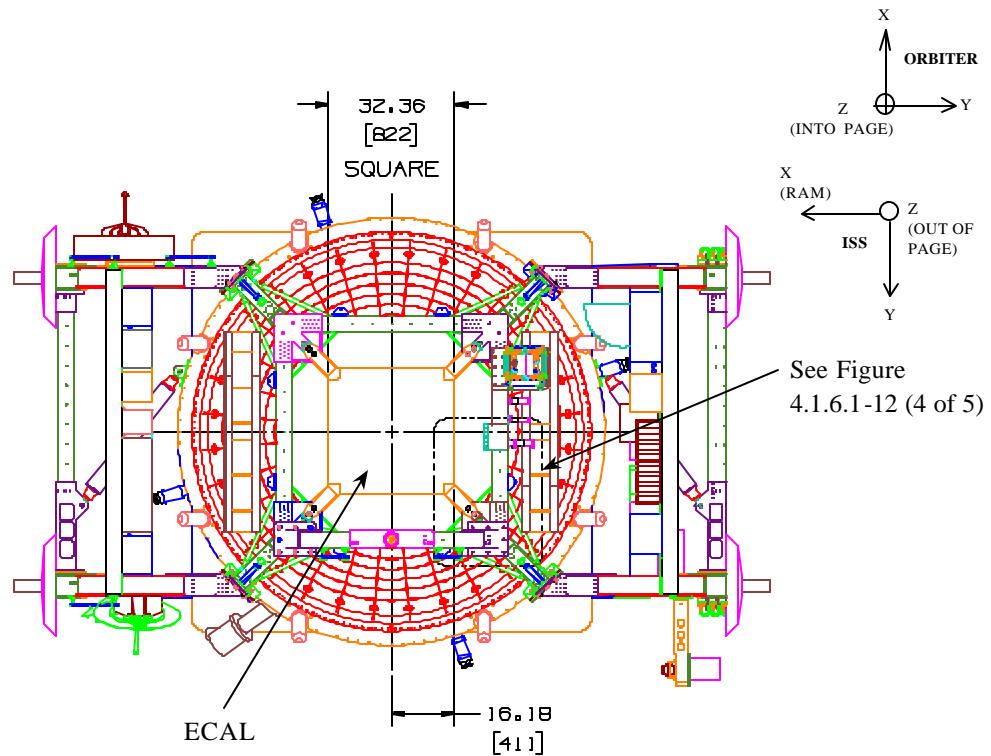


Figure 4.1.6.1-12 ECAL to USS-02 Mounting Locations (3 of 5)

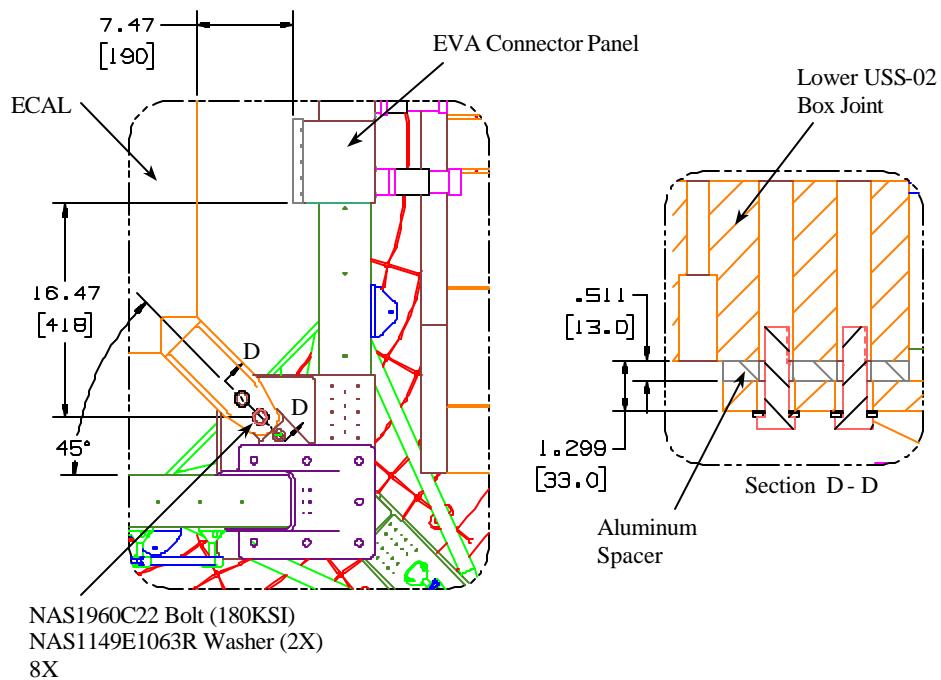


Figure 4.1.6.1-12 ECAL to USS-02 Mounting Locations (4 of 5)

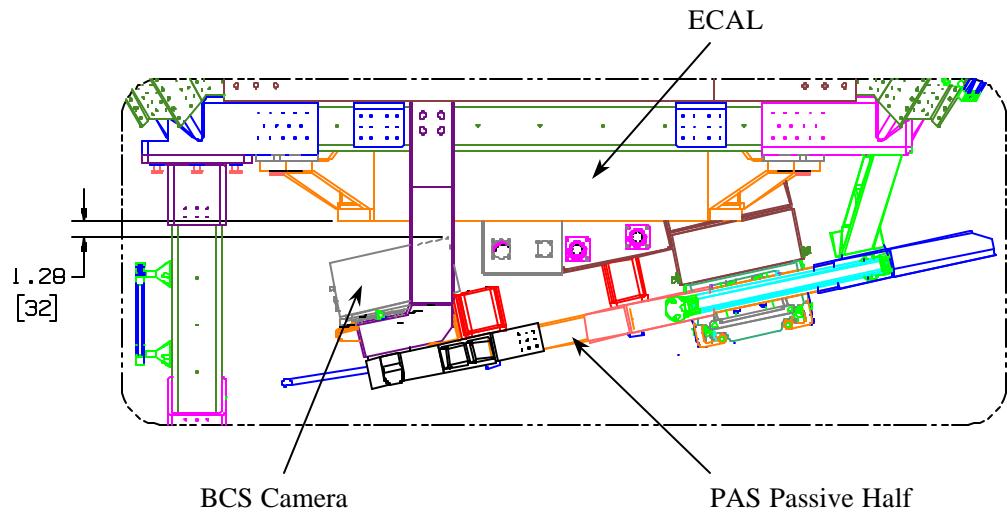


Figure 4.1.6.1-12 ECAL to USS-02 Mounting Locations (5 of 5)

E. Experiment Electronics Interfaces to USS-02

The experiment electronics interfaces are at various locations on the USS-02. The majority of the electronics crates mount to the crate racks.

1. Electronics Crates

There are 4 electronics racks that are used to mount the majority of the electronics crates. These racks are mounted to the USS-02 using existing mounting holes. The locations and mounting scheme are TBD and will be shown in Figure 4.1.6.1-13.

Figure 4.1.6.1-13 Electronic Rack Interfaces (TBD)

2. CAB Electronics

The Cryomagnet Avionics Box (CAB) will be mounted to the Upper USS-02 as shown in Figure 4.1.3-1. The detailed attachment scheme is TBD and will be shown in Figure 4.1.6.1-14.

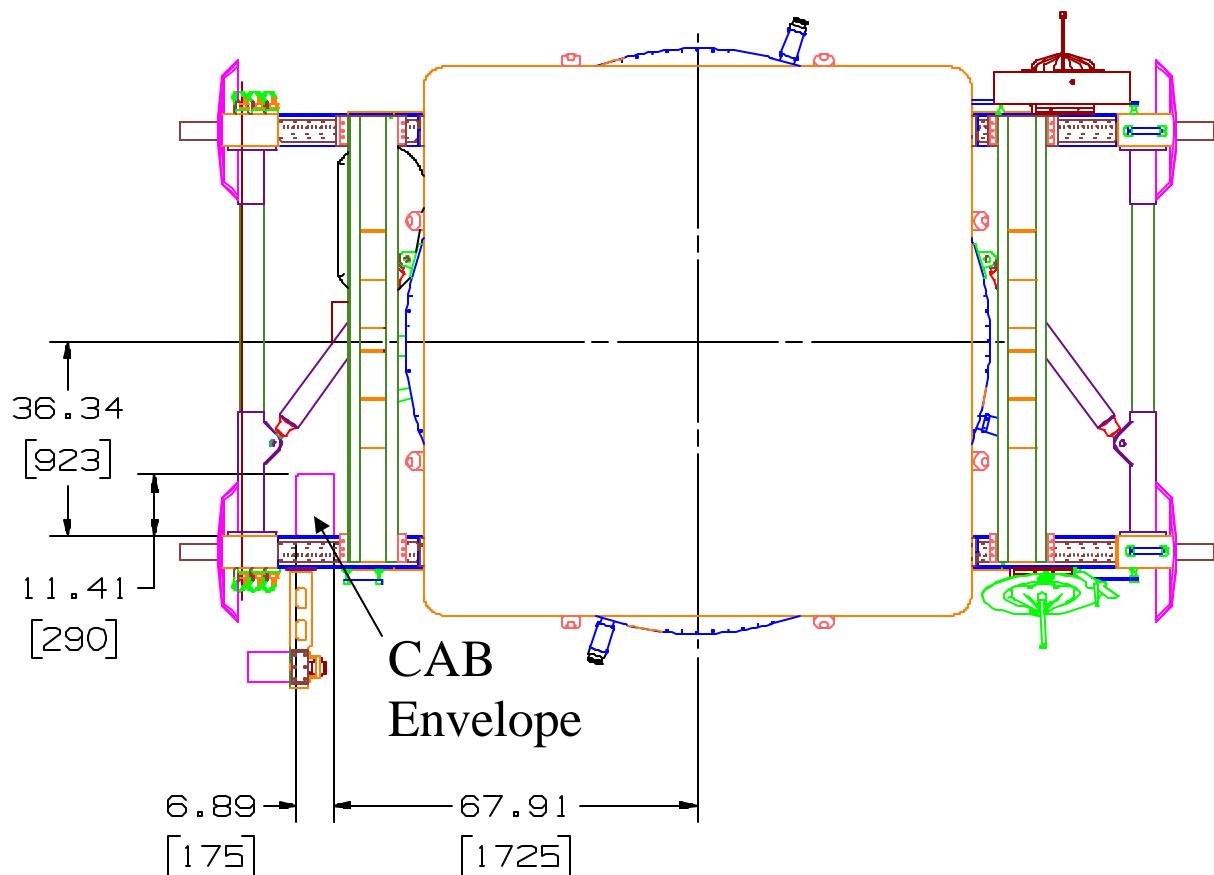


Figure 4.1.6.1-14 CAB Interface (1 of 4)

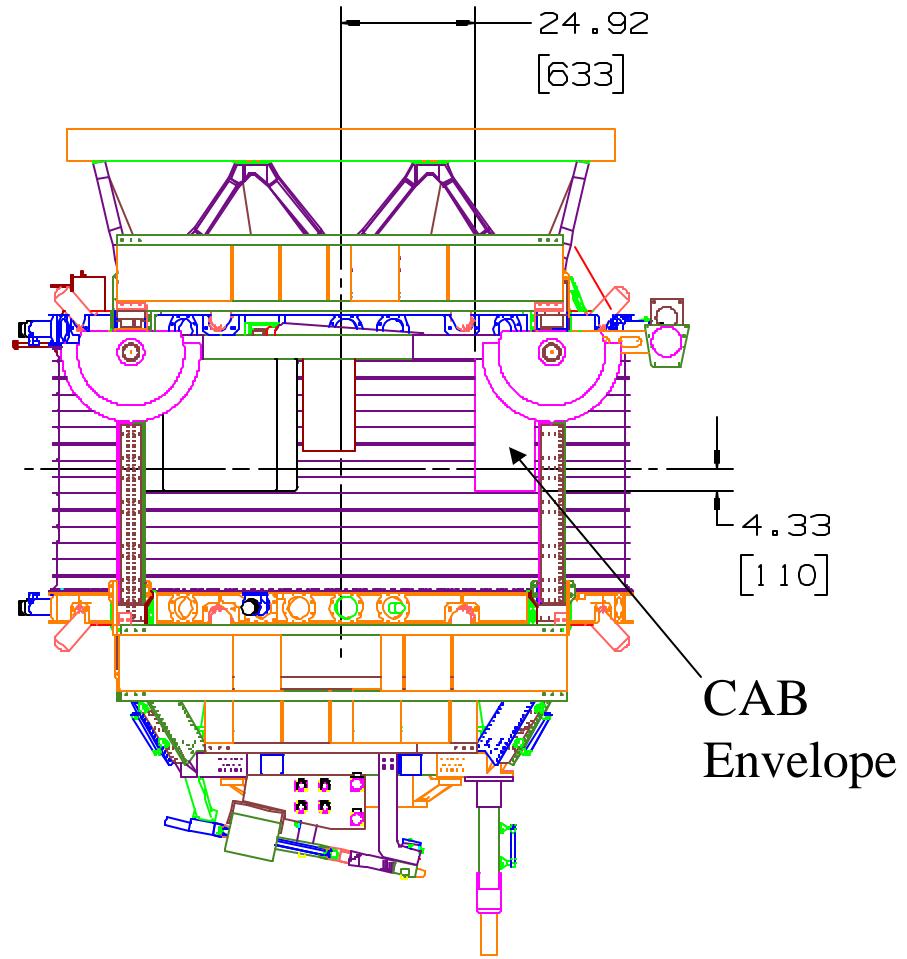


Figure 4.1.6.1-14 CAB Interface (2 of 4)

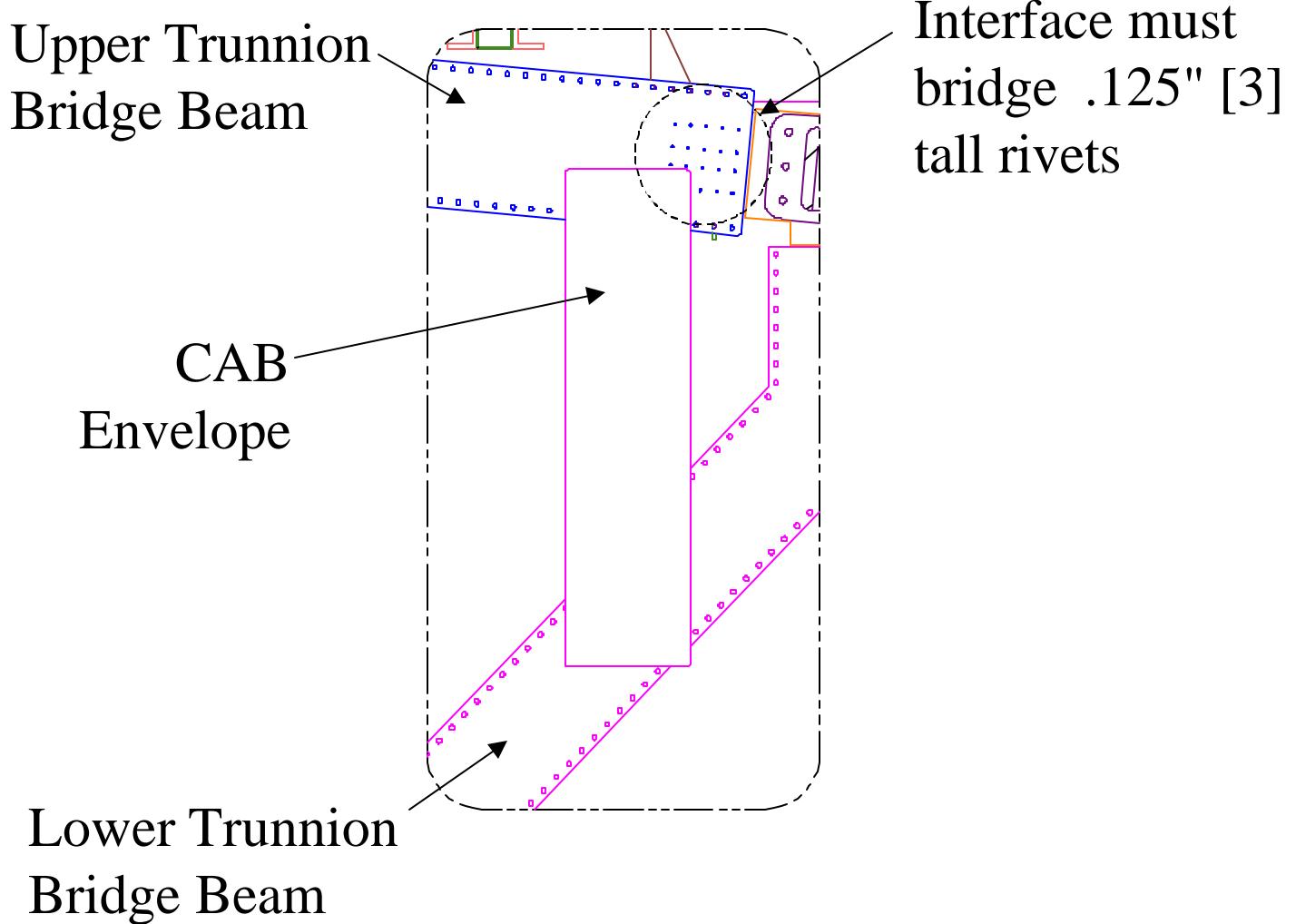


Figure 4.1.6.1-14 CAB Interface (3 of 4)

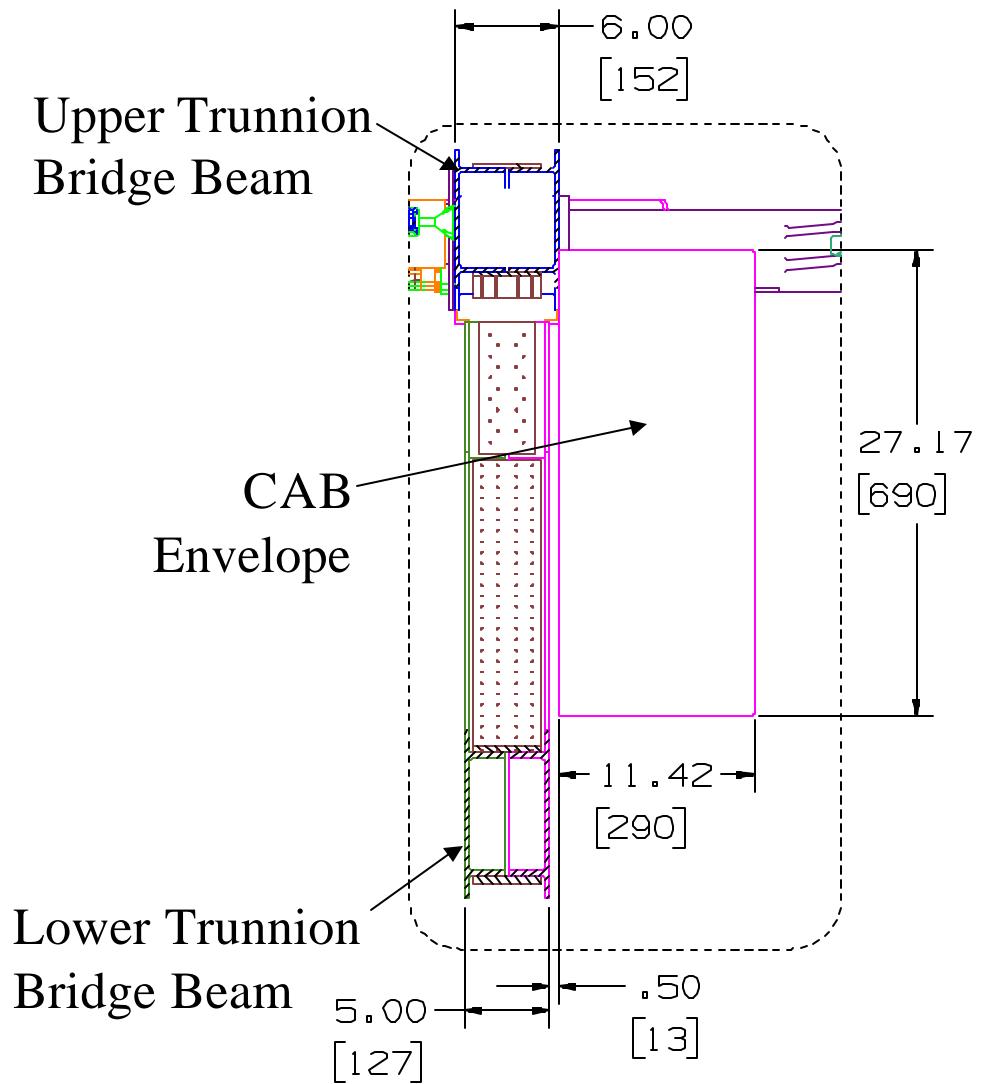


Figure 4.1.6.1-14 CAB Interface (4 of 4)

3. Cryocooler Controller

4. Cryomagnet Rectifiers

The Cryomagnet Rectifiers will be mounted to the Upper USS-02 trunnion blocks. The detailed attachment scheme is **TBD** and will be shown in Figure 4.1.6.1-15.

Figure 4.1.6.1-15 Cryomagnet Rectifier Interfaces (TBD)

5. Cabling

The electronics will require numerous cables that must be routed along the USS-02. A generic hole pattern has been provided on the USS-02 to accommodate this cabling. The generic pattern is composed of inserts for #10 bolts and is shown in Figure 4.1.6.1-16. Currently this interface is **TBD**.

Figure 4.1.6.1-16 Cabling Interface (TBD)

F. Experiment Thermal Control System (TCS) Interfaces to USS-02

The TCS for the AMS-02 is currently **TBD**. The interfaces are **TBD**.

1. TCS Electronics

The TCS electronics could mount separately to the USS-02, but this is currently **TBD**. Figure 4.1.6.1-17 shows the TCS Electronics Interface.

Figure 4.1.6.1-17 TCS Electronics Interface (TBD)

2. TCS Radiators

The TCS Radiators will be mounted to the USS-02. Some could be incorporated as part of the M&OD shields, but all of this is **TBD**. Figure 4.1.6.1-18 shows the TCS Radiator Interfaces.

Figure 4.1.6.1-18 TCS Radiators Interface (TBD)

3. TCS Plumbing

All TCS Plumbing is TBD. Figure 4.1.6.1-19 shows the TCS Plumbing Interfaces.

Figure 4.1.6.1-19 TCS Plumbing Interface (TBD)

4. TCS Cabling

All TCS Cabling is TBD. Figure 4.1.6.1-20 shows the TCS Cabling Interfaces.

Figure 4.1.6.1-20 TCS Cabling Interface (TBD)

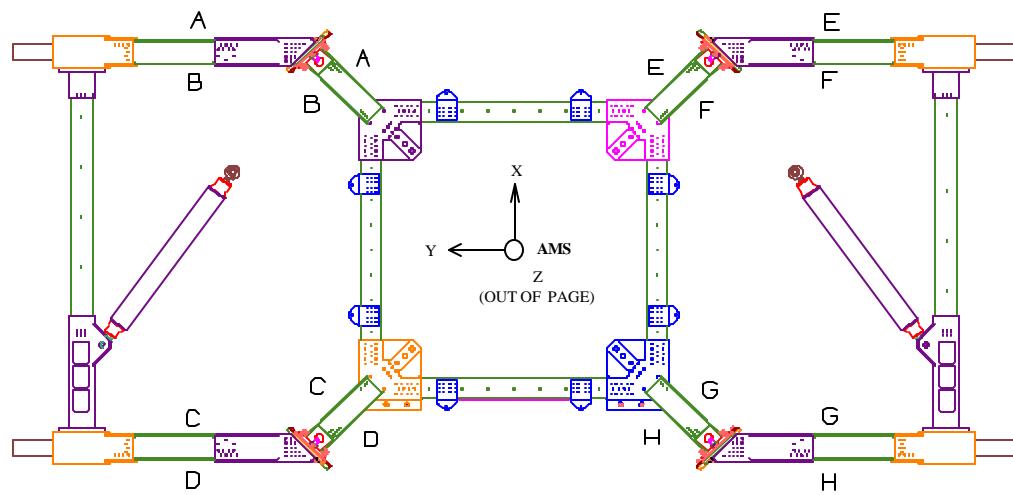
5. Thermal Blankets

All Thermal blankets will be considered as integration hardware. The interfaces are currently TBD. Figure 4.1.6.1-21 shows the Thermal Blanket Interfaces.

Figure 4.1.6.1-21 Thermal Blankets Interface (TBD)

G. Generic Attachment Points on USS-02

1. Unique Support Structure includes numerous generic hole patterns to allow the mounting of small experiment hardware. Masses attached to the generic holes must not create more than 22 lbs of force in any direction at any hole when simultaneously subjected to 1g acceleration in each of the three orthogonal axes. Figure 4.1.6.1-22 shows details of these hole patterns. Refer to Appendix A for each hole's location relative to the AMS-02 origin.



HOLE IDENTIFICATION

Figure 4.1.6.1-22 Generic Hole Patterns on USS-02 (1 of 6)

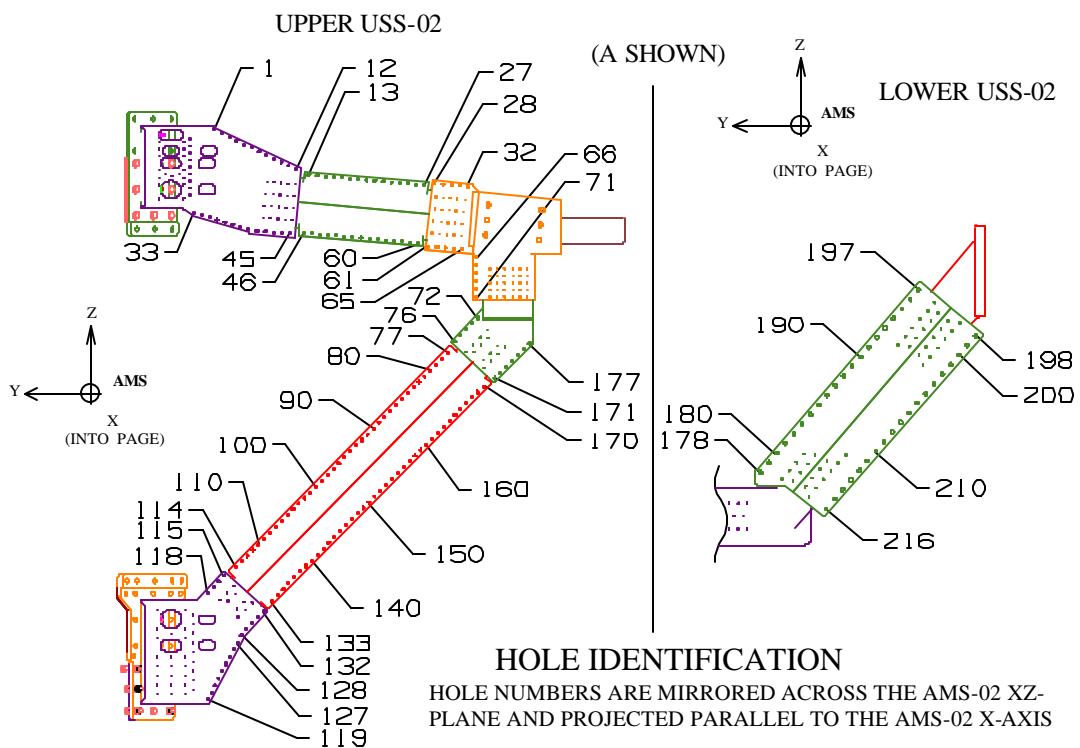


Figure 4.1.6.1-22 Generic Hole Patterns on USS-02 (2 of 6)

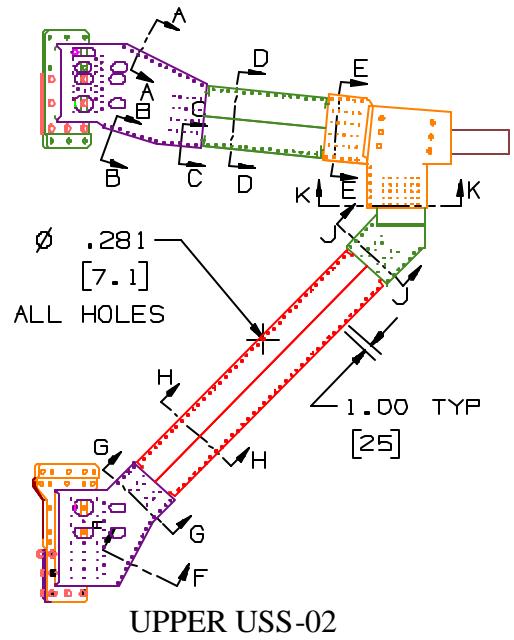
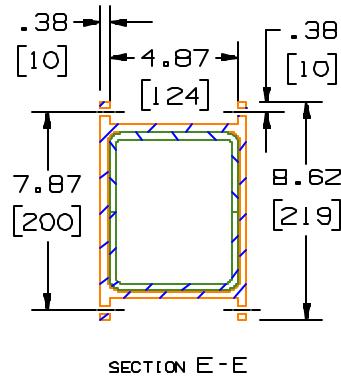
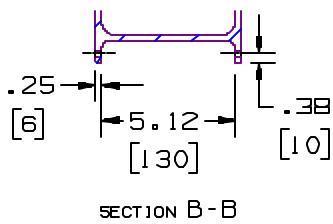
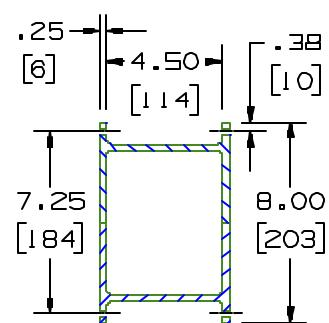
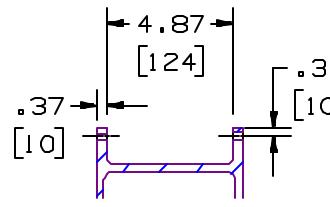


Figure 4.1.6.1-22 Generic Hole Patterns on USS-02 (3 of 6)



SECTION C - C

Figure 4.1.6.1-22 Generic Hole Patterns on USS-02 (4 of 6)

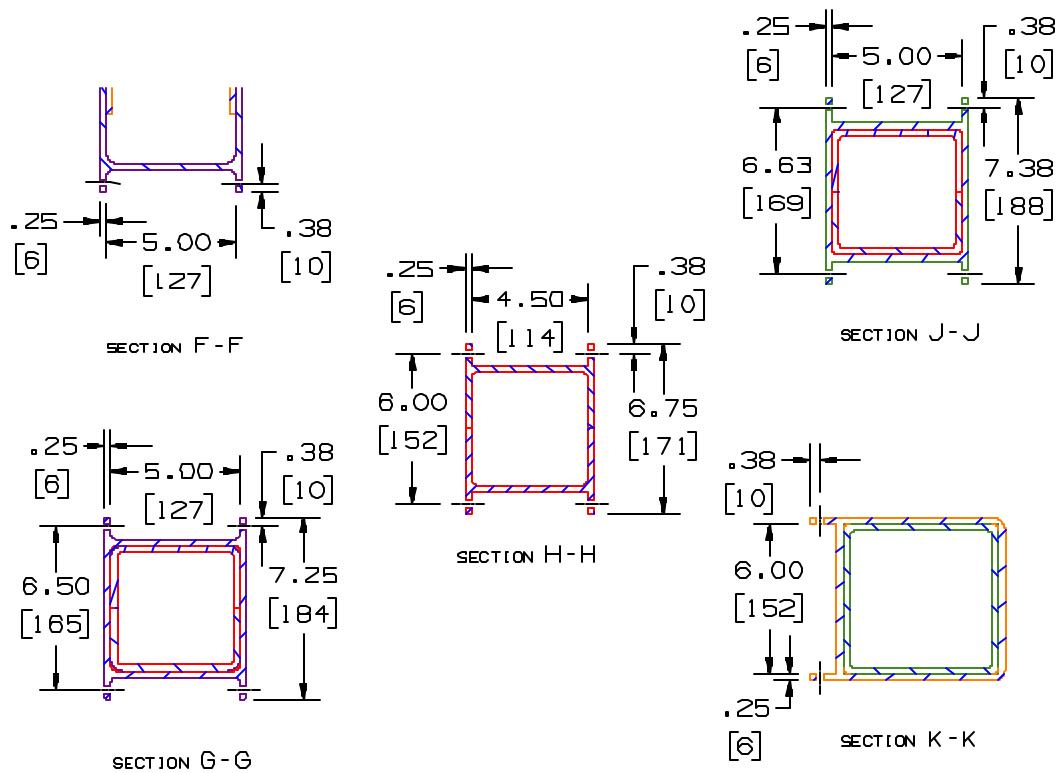
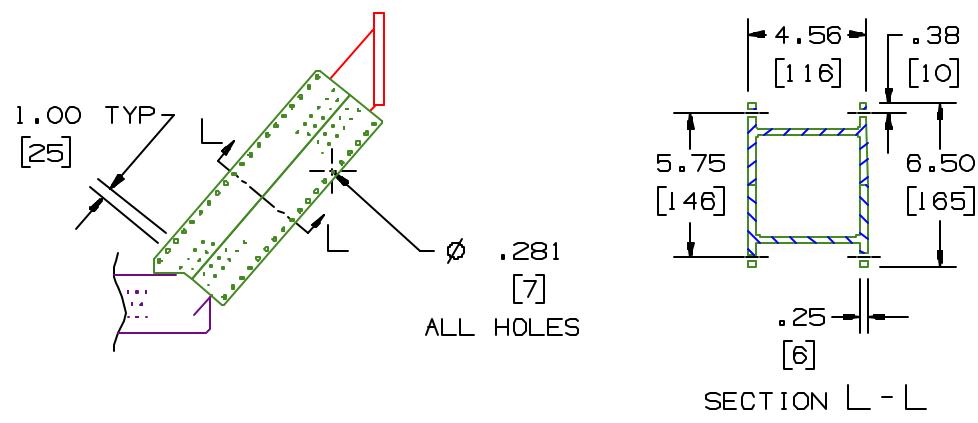


Figure 4.1.6.1-22 Generic Hole Patterns on USS-02 (5 of 6)



LOWER USS-02

Figure 4.1.6.1-22 Generic Hole Patterns on USS-02 (6 of 6)

H. Space Shuttle Integration Hardware Interfaces to USS-02

1. Remotely Operated Electrical Umbilical (ROEU)

The ROEU will be used to make the electrical interface between the Shuttle and the AMS-02 payload. The ROEU mounting and interface configurations with the USS-02 near the primary starboard trunnion are shown in Figure 4.1.6.1-23. The requirements for mounting the ROEU can be found in NSTS-21000-ISS-IDD.

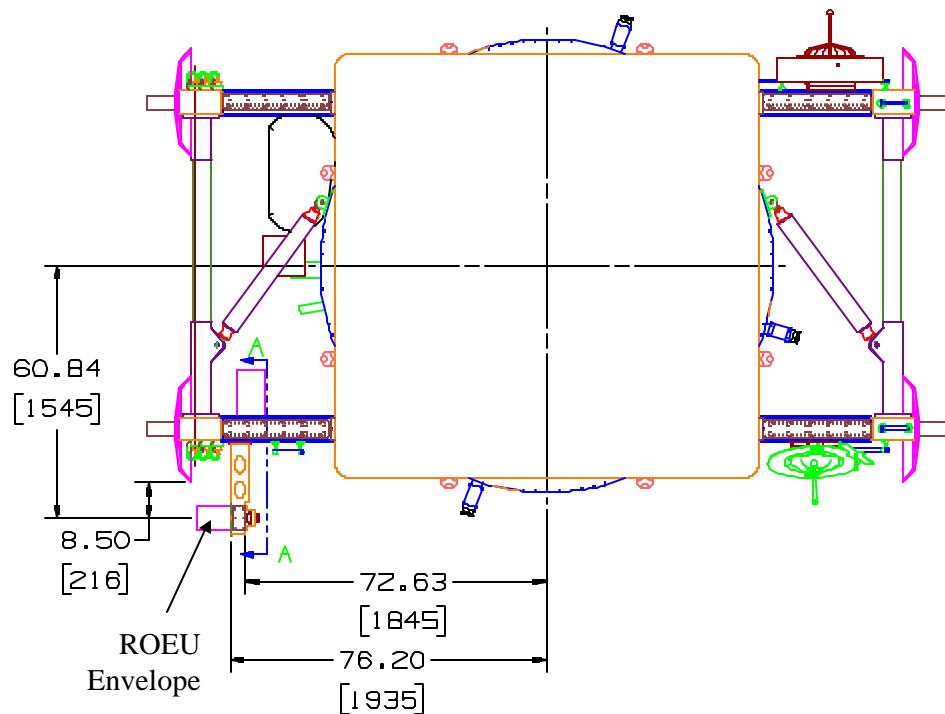


Figure 4.1.6.1-23 ROEU Interface (1 of 3)

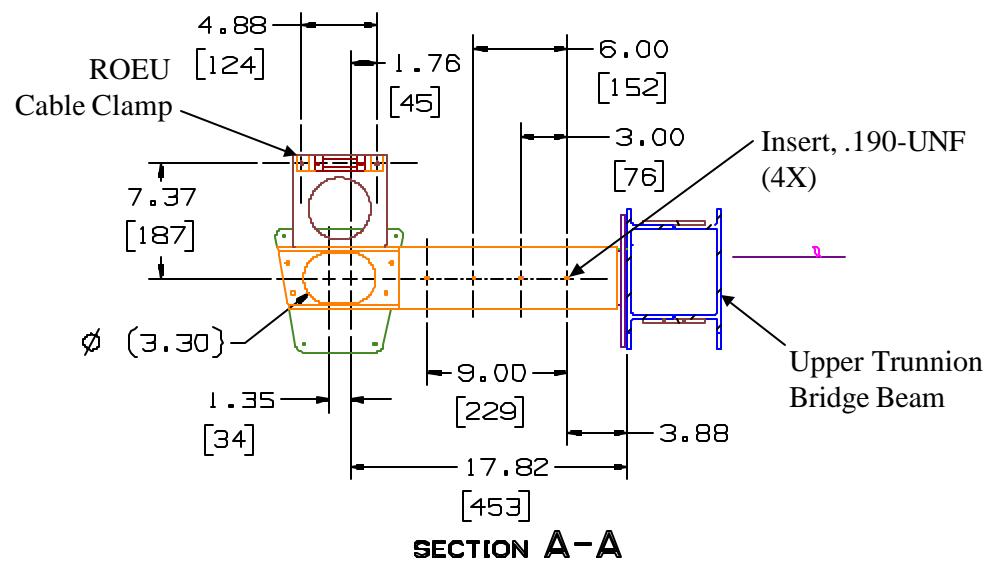


Figure 4.1.6.1-23 ROEU Interface (2 of 3)

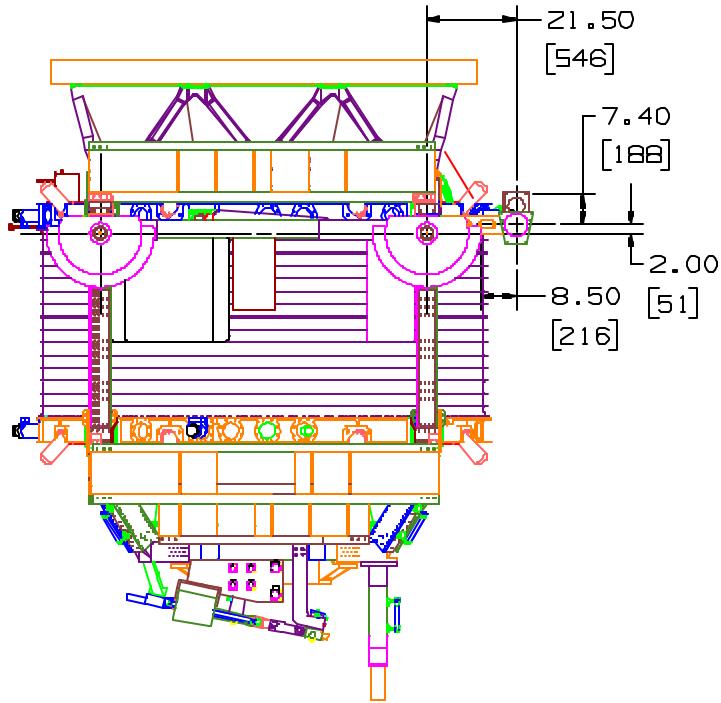


Figure 4.1.6.1-23 ROEU Interface (3 of 3)

I. System (PEDS)

1. Flight Releasable Grapple Fixture (FRGF)

A FRGF will be used on the payload as shown in Figure 4.1.6.1-24. The FRGF will be used by the Shuttle Remote Manipulator System (SRMS) to lift the AMS-02 out of the payload bay. The mounting details for the FRGF are currently TBD, but the requirements can be found in NSTS-21000-ISS-IDD. Figure 4.1.6.1-24 shows the FRGF Interface.

Figure 4.1.6.1-24 FRGF Interface (TBD)

J. International Space Station Integration Hardware Interfaces to USS-02

1. Power Video Grapple Fixture (PVGF)

A PVGF will be used on the payload as shown in Figure 4.1.3-1. The PVGF will be used by the Space Station Remote Manipulator System (SSRMS) to place the AMS-02 on to the truss attach site. The mounting details for the PVGF are currently **TBD**, and the requirements are **TBD** by ISS in SSP-57003. Figure 4.1.6.1-25 shows the PVGF Interface.

Figure 4.1.6.1-25 PVGF Interface (TBD)

2. Passive Payload Attach System (PAS)

The passive PAS will be used to mechanically attach AMS-02 to the ISS truss attach site. The PAS attaches to the lower USS-02 as shown in Figure 4.1.3-1 and 4.1.6.1-3. Detailed attachment of the PAS to the lower USS-02 is **TBD**. Figure 4.1.6.1-26 shows the PAS Interfaces.

Figure 4.1.6.1-26 PAS Interfaces (TBD)

3. Passive Umbilical Mechanism Assembly (UMA)

The passive UMA will be used to electrically attach AMS-02 to the ISS truss attach site. The UMA attaches to the lower USS-02 as shown in Figure 4.1.3-1 and 4.1.6.1-3. Detailed attachment of the UMA to the lower USS-02 is **TBD**. Figure 4.1.6.1-27 shows the UMA Interfaces.

Figure 4.1.6.1-27 UMA Interfaces (TBD)

4. UMA / EVA Cable Interfaces

Figure 4.1.6.1-28 UMA / EVA Cable Interfaces (TBD)

5. Berthing Cues System (BCS)

The BCS is a camera and avionics package that is electrically connected to the PVGF. The system will be used to view the AMS-02 during the berthing operation to the ISS truss attach site. The BCS attaches to the lower PAS Assembly. Detailed attachment of the BCS to the lower USS-02 is **TBD** by ISS. Figure 4.1.6.1-29 shows the BCS Interfaces.

Figure 4.1.6.1-29 BCS Interfaces (TBD)

5. Meteoroid & Orbital Debris Shielding

M&OD shielding will be mounted to the USS-02 at various places. The design and attachment for the shielding is currently **TBD**. Figure 4.1.6.1-30 shows the detailed attachments of the M&OD shielding to the USS-02.

Figure 4.1.6.1-30 M&OD Shielding Interfaces (TBD)

K. International Space Station Integration Hardware Interfaces to Vacuum Case

1. Meteoroid & Orbital Debris Shielding

M&OD shielding may be mounted to the Vacuum Case. The design and attachment for the shielding is currently **TBD**. Figure 4.1.6.1-31 shows the detailed attachments of the M&OD shielding to the Vacuum Case.

Figure 4.1.6.1-31 M&OD VC Shielding Interfaces (TBD)

4.1.6.2 Structural Finish and Flatness

All AMS-02 experiment structural interfaces shall have a surface finish of TBD micro-inches or better. Mounting surfaces shall not be painted, but shall be anodized or alodined aluminum.

4.1.6.3 Bolt Torques

The bolt torques shall be as shown in the Table 4.1.6.3-1

TABLE 4.1.6.3-1 BOLT TORQUES (TBD)

4.3 LIMIT-LOAD FACTORS

Table 4.3-1 and 4.3-2 (extracted from JSC-28792, Section 4.1) show the design load factors for the primary structure of the AMS payload. The USS-02, magnet vacuum case, magnet support system, and the magnet support structure are considered primary structural elements. The key to Table 1 is as follows: **N** represents translational load factors in terms of gravities; **R** represents rotational load factors in terms of rad/sec/sec. All possible permutations of +/- loads shall be considered in the strength assessment. Note that random vibration loads are not added to the primary structures because of their large mass. The load factors were coordinated with the NASA Structures Working Group. On-orbit loads are defined in SSP-57003 (Section 3.5.1.12) and represent the worst loads due to berthing and re-boost events on ISS.

Event	N₊	N₋	N_±	R₊	R₋	R_±
Liftoff	+5.7	+1.6	+5.9	+10	+25	+18
Landing	+4.5	±2.0	±6.5	±20	±35	±15

TABLE 4.3-1 LIFTOFF AND LANDING DESIGN LIMIT LOAD FACTORS

4.4 EMERGENCY LANDING LOAD FACTORS

The emergency landing load factors are found in Table 4.1.1.3.3-1 of NSTS-21000-IDD-ISS and are listed in Table 4.4-1 below (extracted from JSC-28792, Table 3).

Nomenclature is the same as for liftoff and landing. These loads are considered ultimate loads. Note that the design limit loads for liftoff and landing envelope these loads.

N_x	N_y	N_z
+4.5	+1.5	+4.5
-1.5	-1.5	-2.0

TABLE 4.4-1 EMERGENCY LANDING ULTIMATE LOAD FACTORS

4.5 FACTORS OF SAFETY FOR STRUCTURAL DESIGN

For primary structure, minimum safety factors and loads as defined in JSC-28792, "AMS-02 Structural Verification Plan for STS and ISS," shall be used for structural design, analyses and testing. Ultimate loads are maximum operating loads multiplied by the safety factor. The USS-02 structural hardware will be strength tested; therefore, a minimum allowable safety factor shall be used as specified in the AMS-02 Structural Verification Plan and approved by the SWG and in accordance with Section 208.1 of NSTS 1700.7B, and by the ISS Structures Team and in accordance with Section 208.1 of NSTS 1700.7B ISS Addendum.

For most secondary structure a minimum safety factor of 2.0 shall be used as the standard value in structural design to determine ultimate loads. The resulting strength will be based on analysis only. This will require approval by the SWG and the ISS Structures Team. The complete listing of safety factors can be found in JSC-28792.

{Note: Factor of safety requirements above were copied from Revision A to the AMS PRD/PMP (JSC-27296).}

4.6 FRACTURE CONTROL

Fracture control requirements in NASA-STD-5003, "Fracture Control Requirements for Payloads Using the Space Shuttle," and SSP 30558, "Fracture Control Requirements for Space Station" will both be implemented in accordance with JSC-25863, "Fracture

Control Plan for JSC Flight Hardware. The PIB shall be responsible for all fail-safe and fracture analysis required for the AMS Payload.

{Note: Fracture control requirements above were copied from Revision A to the AMS PRD/PMP (JSC-27296) and the responsibility sentence was derived from the AMS SVG (JSC-28792).}

4.7 THERMAL CONTROL

During pre-launch, ascent and descent mission phases, the AMS-02 experiment will employ passive thermal control. During the ISS on-orbit phases of the mission, active thermal control in the form of heaters and cooling loops will be utilized by the AMS-02 experiment package. The AMS-02 experiment developers will provide a thermal model of the AMS-02 experiment to evaluate on-orbit thermal constraints no later than **TBD**.

4.7.1 Active Thermal Control

The AMS-02 experiment package shall be thermally conditioned against cold and hot extremes by the use of electric heaters and pumped cooling loops controlled by the AMS-02 experiment.

4.7.2 Passive Thermal Control

Passive thermal control will be employed for all mission phases.

4.7.2.1 Thermal Isolator

Thermal isolators will be provided by the integration contractor that will limit thermal conduction between the AMS-02 experiment and the support structure to less than **TBD**.

5.0 FUNCTIONAL REQUIREMENTS

This section discusses AMS-02 experiment access requirements and environments.

5.1 ACCESS

The following access requirements are specified for AMS-02.

5.1.1 Preflight

Superfluid Helium top off at the Pad is required up to L-88 hours. Personnel must clear the Pad at L-80 hours.

5.1.2 Postflight

None identified

5.2 AMS-02 ENVIRONMENTS

The environmental conditions for the AMS-02 experiment during ground transportation, launch, ISS operations, re-entry, and landing mission phases are specified in the following subparagraphs.

5.2.1 Handling Environment

5.2.1.1 Shock

Shock will be minimized by the design of the AMS-02 shipping container and mode of transportation.

5.2.1.2 Acceleration

The factors of safety for the transportation of the primary support stand of AMS-02 are provided in Table 5.2.1.2-1. The structure is designed to this safety factor per KHB 1700.7C, SW-E-0002E and NSS/GO-1740.9B.

Load Case		Static	Forklift	Hoist	Truck	Air
Factor of Safety	Ultimate			5.0	3.0	3.0
	Yield	3.0	3.0	3.0	2.0	2.0
Load Factor	Fore/Aft		1.0 / -1.0		1.5 / -1.5	3.0 / -3.0
	Lateral		0.5 / -0.5		1.5 / -1.5	1.5 / -1.5
	Up/Down(+)	1.0	2.0	1.0	3.0	3.0 / -3.0
Load Condition		1g down	Simultaneously	1 g down	Independent +gravity (except Up/Down)	Simultaneously

TABLE 5.2.1.2-1 TRANSPORTATION LOAD FACTORS FOR PRIMARY SUPPORT STAND

5.2.2 Natural Environments

The following natural environmental criteria are provided as reference information to be considered in the design of the payload, experiments, and/or experiment protection against the environment during ground handling and transportation.

5.2.2.1 Atmospheric Surface Pressure

Surface pressure 12.36 to 15.23 psia (85219.2 to 105007.2 N/M²)

5.2.2.2 Atmospheric/Ambient Temperature

The temperature environments associated with the orbiter are provided in Table 5.2.2.2-1

LOCATION/MISSION PHASE	TEMPERATURE °F		REMARKS
	MIN	MAX	
PPF LAB AREA	66	76	50% MAX. REL. HUM.
SSPF LPIS STAND (CITE)	66	76	50% MAX. REL. HUM.
P/L CANISTER	66	76	50% MAX. REL. HUM
ORBITER – ON PAD	40	120	CARGO BAY WALL TEMP. FOR AN ASSUMED ADIABATIC CARGO ELEMENT
LIFT – OFF & LAUNCH	40	150	CARGO BAY WALL TEMP. FOR AN ASSUMED ADIABATIC CARGO ELEMENT

TABLE 5.2.2.2-1 ATMOSPHERIC/AMBIENT TEMPERATURE

5.2.2.3 Fungus

Temperature above 68 degrees F (20 degrees C) and relative humidities above 75 % are conducive to high growth rates of fungi (including mold) and bacteria and the design should utilize non-fungi nutrient materials.

5.2.2.4 Humidity

For design purposes, 0 to 100 percent relative humidity at the temperature extremes defined herein shall be the consideration. For those requiring detailed definition of the extreme surface humidity, the following is provided in three categories:

- a. High Temperature/High Vapor Concentration. The following extreme humidity cycle of 24 hours should be considered in design: 3 hours of 99°F (37.2°C) air temperature at 50 percent humidity and vapor concentration of 9.7 gr/ft³ (22.2 g/m³); 6 hours of decreasing air temperature to 76°F (24.4°C) with relative humidity increasing to 100 percent (saturation); 8 hours of decreasing air temperature foot of

- air (3.8 grams of water as liquid per cubic meter of air), humidity remaining at 100 percent; and 7 hours of increasing air temperature to 99°F (37.2°C) and a decrease to 50 percent relative humidity.
- b. A vapor concentration of 2.1 gr/ft³ (4.8 g/m³), corresponding to a dew point of 32°F (0.0°C) at an air temperature of 100°F (37.8°C) and a maximum relative humidity of 26 percent at an air temperature of 70°F (21.1°C) remaining 20 hours of each 24 hours for 10 days.
 - c. Low Temperature/Low Vapor Concentration A vapor concentration of 0.9 gr/ft³ (2.1 g/m³), with an air temperature of 11°F (-11.7°C) and a relative humidity between 98 and 100 percent for a duration of 24 hours.

5.2.2.5 Ozone

Surface maximum 3 to 6 parts per hundred million (phm); 35,000 feet (10,668 m) maximum 100 phm. Total oxidant concentrations may infrequently reach 69 phm for 1 to 3 hours during a 24 hour period. Levels increase with altitude to maximum value of 1100 phm near 98,000 feet (29,870 m).

5.2.2.6 Salt Spray

Design Model - 1.0 percent by weight salt (NaCl) solution for 30 days.

Note: For those requiring detailed definition the following data is provided.

Natural environments conducive to salt spray corrosion of metals or obscuration of optical surfaces at the surface exist at Kennedy Space Center (KSC). Extreme salt spray characteristics are as shown in Table 5.2.2.6-1.

Particle Diameter	0.1 to 20 Microns*
Fallout Rate on fair day per sq. ft. / day	5×10^{-8} lbs.
Fallout Rate on rainy day	1×10^{-6} lbs. Per sq. ft / day
Fallout Coating on a fair day	4 Microns / day
Fallout Coating in a rainy day	100 Microns / day

*98% of mass occurs with particles greater than 0.8 Microns

TABLE 5.2.2.6-1 EXTREME SALT SPRAY CHARACTERISTICS

5.2.2.7 Sand/Dust

(Shelter Storage and uncontrolled interior vehicle areas) equivalent to 140-mesh silica flour with particle velocity up to 500 feet per minute and a particle density of 0.25 grams/cubic foot.

5.2.3 Prelaunch Environments

5.2.3.1 Temperature

Temperature environments within the orbiter associated with prelaunch checkout and transportation at KSC are provided in Table 5.2.2.2-1.

5.2.3.2 Purge System

The Orbiter cargo bay purge system permits the purge gas to meet unique thermal conditioning requirements. The purge gas exits the cargo bay via check valves on the Xo 1307 (33197.8) bulkhead for flows up to 180 lbs/min (81.6 kg/min). For flow rates greater than 180 lbs/min., the excess exits via vent port No. 6 (left and right side). Distribution of the purge gas from the spigots to the required areas on/in the payload is by means of payload supplied, payload chargeable ducting attached to any one, all, or any combination of the three spigots. The cargo bay purge system conditions air to the cargo bay during prelaunch operations until 80 minutes prior to Orbiter cryogenics loading.

Starting at 80 minutes prior to Orbiter cryogenics loading, Gaseous Nitrogen (GN₂) will be supplied to provide an inert cargo bay atmosphere at lift-off. For operational purge flow rates exceeding 180 lbs/min (81.6 Kg/min) the purge flow rate will be gradually reduced to 145 plus or minus 35 lbs/min. between T-2 minutes and T-20 seconds before launch. In the event of a launch hold or pad abort the prelaunch purge flow can be reestablished within two minutes. During the flow rate adjustments, the purge gas temperature will be within plus or minus 20°F (plus or minus 11.1°C) control band within 14 minutes. The supply pressure levels provided just upstream of the ground portion of the umbilical disconnect on the pad are as follows:

- a. The 2.5 (17.2 K N/m²) psig system supplies either air or GN₂ to the cargo bay during all operations not involving cryogenic payloads.
- b. The high pressure system 11 (75.8 K N/m²) psig spigots closed or 5.3 (36.5 K n/m²) psig spigots full open, supplies only GN₂ and is used for cryogenic payloads.

Within forty-five minutes following touchdown the purge system supplies conditioned air to the cargo bay utilizing a 2.0 (13.8 K N/mz) psig supply pressure.

The purge gas will be either air or GN₂. The gas will be nominally class 100, guaranteed class 5000 (HEM) filtered with 15 ppm or less hydrocarbons based upon a methane equivalent.

Continuous purging can be supplied during closed cargo bay canister operations except during transfer between mobile Ground Support Equipment (GSE) and facility services at the Multi-Payload Processing Facility (MPPF), Space Station Processing Facility (SSPF), and the Pad, and during towing from the Orbiter Processing Facility (OPF) until completion of the Orbiter mating activities in the Vehicle Assembly Building (VAB). During cargo bay air purge interruptions, the cargo bay vent will be closed.

5.2.4 Space Environments

5.2.4.1 Pressure

The AMS-02 Payload will be exposed to an on-orbit minimum pressure environment of 1.93E-09 pounds per square inch absolute (psia) (1.0 x 10E-07 Torr). This is to be used for design and analysis purposes. This requirement is found in the ISS IRD # SSP 57003, Section 3.5.1.1

5.2.4.2 Thermal Environment

The AMS-02 will be exposed to thermal solar constants, albedo, and earth Outgoing Long-wave Radiation (OLR) environments as defined in Table 5.2.4.2-1; a space sink temperature of 3 K; the induced thruster plume environment and induced thermal environments from vehicle(s) docking and docked with the ISS; and thermal interactions with other on-orbit segments. Induced thermal effects on AMS-02 Payload due to beta angle extremes, orbital altitude, and attitude variation about the ISS vehicle axes are

provided in Table 5.2.4.2-2. These environments are to be used for design and analysis purposes.

Case	Solar Constant (W/m ²)	Earth Albedo	Earth Outgoing Long Wave Radiation (W/m ²)
Cold	1321	0.2	206
Hot	1423	0.4	286

TABLE 5.2.4.2-1 HOT AND COLD NATURAL THERMAL ENVIRONMENTS

Induced Environment	Assumed Parameters (Degrees F)
Beta Angle	+/- 75 ⁰
Altitude	150 nmi. To 270 nmi.
Attitude Envelope Without Orbiter	Any combination of +/- 15 ⁰ Roll, + 15 ⁰ to - 20 ⁰ Pitch, and +/- 15 ⁰ Yaw
Attitude Envelope With Orbiter Docked to ISS	Any combination of +/- 15 ⁰ Roll, 0 ⁰ to 25 ⁰ Pitch, and +/- 15 ⁰ Yaw

Roll = Variation about X axis

Pitch = Variation about Y axis

Yaw = Variation about Z axis

This requirement is found in the ISS IRD # SSP 57003, Section 3.5.1.2

TABLE 5.2.4.2-2 INDUCED THERMAL ENVIRONMENTS

5.2.4.3 Solar Radiation (Nuclear)

The natural nuclear radiation environment in terrestrial space consists of: (1) Galactic cosmic radiation; see Table 5.2.4.3-1, (2) geomagnetically trapped radiation; see Table 5.2.4.3-2, and (3) solar flare particle events; see Table 5.2.4.3-3.

Composition	85% protons 13% alpha particles 2% heavier nuclei
Energy Range	10^7 to 10^{19} electron-volts predominately 10^9 to 10^{10} electron-volts
Flux outside earth's magnetic field	0.2 to 0.4 particles/cm ² /steradian/sec
Integrated yearly rate	Approximately 1×10^8 protons per sq. cm
Integrated yearly dose	Approximately 4 to 10 rads

TABLE 5.2.4.3-1 GALACTIC COSMIC RADIATION

Energy Electron	0.5 Me V
Protons	34 Me V
Peak Electron Flux	10^8 Electrons per sq. cm per sec. (omnidirectional)
Peak Electron Flux / Altitude	Approximately 1000 n. mi. at equator
Peak Proton Flux / Altitude	Approximately 1900 n. mi. at equator
Peak Proton Flux	10^4 to 10^5 protons per sq cm per sec. (omnidirectional)

TABLE 5.2.4.3-2 TRAPPED RADIATION (PROTONS, ELECTRONS)

Composition	Energetic protons and alpha particles.
Occurrence	Sporadically and lasting for several days

TABLE 5.2.4.3-3 SOLAR PARTICLE EVENTS

For near-earth orbital altitudes the above free-space event model must be modified since the earth's magnetic field deflects some of the low energy particles that would enter the atmosphere at low altitudes of the poles.

5.2.4.4 Meteoroids and Orbital Debris

The AMS-02 will be exposed to the M/OD environments as specified in SSP 30425, paragraph 8.0. Parameters of ISS M/OD environments definition are given in Table 5.2.4.4-1 and NASA TM 104825. This is to be used for design and analysis purposes. This requirement is found in the ISS IRD # SSP 57003, Section 3.5.1.11.

Altitude	215 Nautical Miles (400 km)
Orbital Inclination	51.6 Degrees
Space Station Altitude	LVLH 10% of the time (Orbiter attached) TEA 90% of the time (Orbiter not attached)
Solar Flux	70×10^4 Jansky ($F_{10.7} - 70$)
Orbital Debris Density (1)	2.8 gm/cm ³
Maximum Debris Diameter (2)	20 cm

NOTE:

- (1) For M/OD critical items (see 6.1) only
- (2) High degree of confidence of collision avoidance for this size and larger orbital objects.

TABLE 5.2.4.4-1 PARAMETERS FOR METEOROIDS AND ORBITAL DEBRIS ENVIRONMENTS DEFINITION

5.2.4.5 Atomic Oxygen

- a) The AMS-02 will be exposed to a flux of 5.0×10^{21} atoms per cm² per year for the on-orbit exposure duration. This is to be used for design and analysis.

Note: The Atomic Oxygen (AO) environment is not applicable to AMS-02 internal surfaces and equipment, except where exposed to the external AO environment during ISS operations.

- b) Surfaces exposed 30 days or less will be exposed up to 4.4×10^{19} atoms per cm² per day. This is to be used for design and analysis purposes.

This requirement is found in the ISS IRD # SSP 57003, Section 3.5.1.4.

5.2.4.6 External Contamination Requirements

The AMS-02 will be exposed to on-orbit external contamination environments as defined in SSP 30426, external Contamination Control Requirements, paragraphs 3.4 and 3.5. This requirement is found in the ISS IRD # SSP 57003, Section 3.5.1.5.

5.2.4.7 Electromagnetic Radiation

AMS-02 EMC design will be exposed to the environment as specified in SSP 30243, paragraph 3.2.3, including applicable references. This is to be used for design and analysis purposes. This requirement is found in the ISS IRD # SSP 57003, Section 3.5.1.6.

5.2.4.8 Plasma

The AMS-02 will be exposed to on-orbit natural plasma environment as specified in SSP 30425, section 5.0 and the induced plasma environment as specified in SSP 30420, Space Station Program Induced Plasma Environment, paragraph 3.3. The difference between the AMS-02 structure floating potential and the local plasma potential does not exceed +/-40 volts. This is to be used for design and analysis purposes. This requirement is found in the ISS IRD # SSP 57003, Section 3.5.1.7.

5.2.4.9 Ionizing Radiation

5.2.4.9.1 Attached Payload Contained or Generated Ionizing Radiation

Attached Payloads containing or using radioactive materials or that generate ionizing radiation shall comply with NSTS 1700.7 ISS Addendum, paragraph 212.1.

5.2.4.9.2 Ionizing Radiation Dose

AMS-02 shall be designed to not produce an unsafe condition or one that could cause damage to external equipment as a result of exposure to a total dose specified in SSP 30512, Ionizing Radiation Design Environment, paragraph 3.1.2.

5.2.4.9.3 Nominal Single Event Effects Ionizing Radiation

AMS-02 shall be designed to operate in and to not produce an unsafe condition or one that could cause damage to other equipment as a result of exposure to the radiation dose environment specified in SSP 30512, paragraph 3.2.1.

5.2.4.9.4 Extreme Single Event Effects

AMS-02 shall be designed to not produce an unsafe condition or one that could cause damage to external equipment as a result of exposure to extreme Single Event Effect (SEE) ionizing radiation assuming exposure levels specified in SSP 30512, paragraph 3.2.2.

5.2.4.10 Solar Ultraviolet Radiation

The AMS-02 will be exposed to on-orbit solar ultraviolet radiation environment as specified in SSP 30425, paragraph 7.2. This is to be used for design and analysis purposes.

5.2.4.11 Plume Impingement

AMS-02 and its exposed secondary structure (e.g., MLI blankets) will be exposed to the maximum effective normal pressure of 3.42 psf and shear plume impingement pressure of 0.80 psf to be used for design and analysis purposes.

5.2.4.12 Acceleration Environment

A. Primary Structure

1. The AMS-02 and its subsystems shall be designed to withstand an on-orbit acceleration environment including reboost having peak transient accelerations as defined in Table 5.2.4.12-1.

B. Secondary Structure

1. The AMS-02 and its subsystems shall be designed to withstand an on-orbit acceleration environment including reboost having peak transient accelerations of up to 0.185 g's, a vector quantity acting in any direction.
2. The AMS-02 and its subsystems shall be designed to withstand berthing the AMS-02 in its berthing configuration having peak transient accelerations of up to 0.185 g's, a vector quantity acting in any direction. This criteria is to be used as a component load factor applied to the subsystem's center of gravity.

This requirement is found in the ISS IRD # SSP 57003, Section 3.5.1.12.

	N _X (m g)	N _Y (m g)	N _Z (m g)
Case 1	40.9	13.1	14.3
Case 2	7.8	56.5	11.5
Case 3	37.3	13.4	25.3

TABLE 5.2.4.12-1 PEAK TRANSIENT ACCELERATIONS

5.2.5 Induced Environments

5.2.5.1 Random Vibration

Table 5.2.5.1-1 provides Flight Random Vibration Levels (FRVL) environment data for the AMS-02 experiment (ref: JSC 28792, Rev. A). This level applies to the payload trunnions. Table 5.2.5.1-2 provides Minimum Workmanship Levels (MWL) environment data for AMS-02 experiment (ref: JSC 28792, Rev. A)

	FREQUENCY (Hz)	LEVEL
X-Axis	20 - 58 58 - 125 125 - 300 300 - 900 900 - 2000	.0025 g ² / Hz +9 Db / Octave 0.025 g ² / Hz -9 dB / Octave .001 g ² / Hz (Overall = 3.1 g RMS)
Y-Axis	20 - 90 90 - 100 100 - 300 300 - 650 650 - 2000	.008 g ² / Hz +9 dB / Octave 0.01 g ² / Hz -9 dB / Octave .001 g ² / Hz (Overall = 2.3 g RMS)
Z-Axis	20 - 45 45 - 125 125 - 300 300 - 900 900 - 2000	.009 g ² / Hz +3 dB / Octave 0.025 g ² / Hz -9 dB / Octave .001 g ² / Hz (Overall = 3.2 g RMS)

TABLE 5.2.5.1-1 FLIGHT RANDOM VIBRATION ENVIRONMENT

All Axes	20 Hz 20-80 Hz 80-500 Hz 500-2000 Hz 2000 Hz Overall = 6.8 Grms	0.1g ² / Hz +3 dB / Octave 0.04 g ² / Hz -3 dB / Octave 0.01g ² / Hz
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(MWL Test Duration: 60 seconds per axis)

TABLE 5.2.5.1-2 MINIMUM WORKMANSHIP LEVELS

5.2.5.2 Acoustics

The acoustic loads environment is defined in the “AMS-02 Structural Verification Plan for the Space Transportation System and the International Space Station” JSC-28792, Rev. A., Section 4.4.

5.2.6 Orbiter Cargo Bay Gaseous Environment

5.2.6.1 Effluents

During the AMS-02 experiment operational periods, nominal on-orbit operation of certain Orbiter subsystems results in scheduled venting of fluid effluent byproducts, which are identified in Table 5.2.6.1-1.

SOURCE	EFFLUENT	DURATION	REMARKS
ECLSS Cabin Air (Com Mode)	Air	2 sec., four to seven times per 24 hours	Depends on number of people
Water vapor from fecal material	H ₂ O	Continuous vent from fecal waste collector	Quantity depends on number of crew
H ₂ Separator (FCP water)	H ₂ O	Continuous	Flow rate 2x10 ⁻⁷ lb/sec
Flash Evaporator Topping Steam Vent (H ₂ O) No. 1 H ₂ O No. 2 H ₂ O		Up to ten hours Up to ten hours	Dependent on fuel cell production rate supplements radiator during orbital operation in conjunction with topping evaporator
Fuel Cell H ₂ Purge O ₂ Purge	H ₂ Gas O ₂ Gas	Normal Mode: 2 minute per FCP Every eight hours for both gases	2 Fuel Cell power plants are purged in sequence resulting in a total venting time of 6 minutes every 9 hours
Water vapor/ice from Water Waste System	H ₂ O	Up to 1.0 hour duration at 150 lbs./hour	Can be scheduled dumps

FCP = Fuel Cell Purge

TABLE 5.2.6.1-1 ORBITER SCHEDULED VENTS

5.2.6.2 Outgassing and Offgassing

The Orbiter vehicle materials will be outgassing and offgassing and the cabin atmosphere leakage as defined in Table 5.2.6.2-1.

MAJOR SOURCE	DURATION/FREQUENCY	CONSTITUENTS	SIZE PARAMETER
Outgassing	Continuous	Hydrocarbon, chain fragments, RTV's etc	Molecular Average M = 100
Offgassing	On orbit continuous for first 100 hours	Water, light gases Volatile	Molecular Average M = 18
Cabin Atmosphere leakage	Continuous	O ₂ , N ₂ , CO ₂ , H ₂ O	Molecular Average M = 29

TABLE 5.2.6.2-1 ORBITER OUTGASSING, OFFGASSING AND CABIN ATMOSPHERE LEAKAGE

5.2.6.3 RSC and VCRS Engine Plumes

The Reaction Control System (RCS) and Vernier Reaction Control System (VRCS) plume constituent products are described in Table 5.2.6.3-1.

STEADY STATE OPERATIONS	RCS	VRCS
Completely Reacted Products		
H ₂ O	0.339	0.333
N ₂	0.039	0.312
H ₂	0.163	0.181
CO	0.129	0.129
CO ₂	0.042	0.042
O ₂	0.002	Traces
NO	0.001	
Free Radicals		
H	0.012	0.003
OH	0.006	Traces
O	Traces	Traces
Pulse Mode Trace Products	(solid or liquid)	
MMH	N ₂ H ₃ CH ₃	
MMH-Nitrate	N ₂ H ₂ CH ₃ NO ₃ ; N ₂ H CH ₃	(NO ₃) ₂
Nitric Acid	HNO ₃	
Ammonium Nitrate	NH ₄ NO ₃	

NOTES: N₂O₄/MMH Exhaust Products (Mole Fractions) and Trace Partially Reacted Contaminants

**TABLE 5.2.6.3-1 RCS AND VRCS PLUME CONSTITUENT PRODUCTS
N₂O₄/MMH EXHAUST PRODUCTS (MOLE FRACTIONS) AND
TRACE PARTIALLY REACTED CONTAMINATES**

APPENDIX A: USS-02 GENERIC HOLE LOCATION COORDINATES

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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A	1	42.15	47.11	34.27
A	2	42.15	48.00	33.83
A	3	42.15	48.90	33.38
A	4	42.15	49.79	32.93
A	5	42.15	50.69	32.49
A	6	42.15	51.58	32.04
A	7	42.15	52.48	31.59
A	8	42.15	53.37	31.15
A	9	42.15	54.27	30.70
A	10	42.15	55.16	30.25
A	11	42.15	56.05	29.80
A	12	42.15	56.95	29.36
A	13	41.84	58.48	28.67
A	14	41.84	59.48	28.57
A	15	41.84	60.48	28.48
A	16	41.84	61.47	28.39
A	17	41.84	62.47	28.30
A	18	41.84	63.46	28.20
A	19	41.84	64.46	28.11
A	20	41.84	65.45	28.02
A	21	41.84	66.45	27.92
A	22	41.84	67.44	27.83
A	23	41.84	68.44	27.74
A	24	41.84	69.44	27.64
A	25	41.84	70.43	27.55
A	26	41.84	71.43	27.46
A	27	41.84	72.42	27.36
A	28	42.15	73.68	27.56
A	29	42.15	74.68	27.47
A	30	42.15	75.67	27.37
A	31	42.15	76.67	27.28
A	32	42.15	77.66	27.19
A	33	42.15	44.56	23.95
A	34	42.15	45.51	23.64
A	35	42.15	46.46	23.34
A	36	42.15	47.41	23.04
A	37	42.15	48.37	22.73
A	38	42.15	49.32	22.43
A	39	42.15	50.27	22.13
A	40	42.15	51.23	21.82
A	41	42.15	52.21	21.68
A	42	42.15	53.21	21.58
A	43	42.15	54.20	21.49
A	44	42.15	55.20	21.40

A	45	42.15	56.20	21.30
A	46	41.84	57.81	21.45
A	47	41.84	58.80	21.36
A	48	41.84	59.80	21.26
A	49	41.84	60.80	21.17
A	50	41.84	61.79	21.08
A	51	41.84	62.79	20.98
A	52	41.84	63.78	20.89
A	53	41.84	64.78	20.80
A	54	41.84	65.77	20.70
A	55	41.84	66.77	20.61
A	56	41.84	67.76	20.52
A	57	41.84	68.76	20.42
A	58	41.84	69.76	20.33
A	59	41.84	70.75	20.24
A	60	41.84	71.75	20.14
A	61	42.15	72.95	19.72
A	62	42.15	73.94	19.63
A	63	42.15	74.94	19.53
A	64	42.15	75.93	19.44
A	65	42.15	76.93	19.35
A	66	42.59	78.70	18.33
A	67	42.59	78.70	17.33
A	68	42.59	78.70	16.33
A	69	42.59	78.70	15.33
A	70	42.59	78.70	14.33
A	71	42.59	78.70	13.33
A	72	42.09	78.88	10.79
A	73	42.09	78.19	10.07
A	74	42.09	77.50	9.35
A	75	42.09	76.80	8.62
A	76	42.09	76.11	7.90
A	77	41.84	75.24	6.43
A	78	41.84	74.54	5.71
A	79	41.84	73.85	4.98
A	80	41.84	73.16	4.26
A	81	41.84	72.47	3.54
A	82	41.84	71.78	2.81
A	83	41.84	71.09	2.09
A	84	41.84	70.40	1.37
A	85	41.84	69.71	0.65
A	86	41.84	69.01	-0.08
A	87	41.84	68.32	-0.80
A	88	41.84	67.63	-1.52

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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A	89	41.84	66.94	-2.24
A	90	41.84	66.25	-2.97
A	91	41.84	65.56	-3.69
A	92	41.84	64.87	-4.41
A	93	41.84	64.18	-5.13
A	94	41.84	63.48	-5.86
A	95	41.84	62.79	-6.58
A	96	41.84	62.10	-7.30
A	97	41.84	61.41	-8.02
A	98	41.84	60.72	-8.75
A	99	41.84	60.03	-9.47
A	100	41.84	59.34	-10.19
A	101	41.84	58.65	-10.91
A	102	41.84	57.95	-11.64
A	103	41.84	57.26	-12.36
A	104	41.84	56.57	-13.08
A	105	41.84	55.88	-13.81
A	106	41.84	55.19	-14.53
A	107	41.84	54.50	-15.25
A	108	41.84	53.81	-15.97
A	109	41.84	53.12	-16.70
A	110	41.84	52.42	-17.42
A	111	41.84	51.73	-18.14
A	112	41.84	51.04	-18.86
A	113	41.84	50.35	-19.59
A	114	41.84	49.66	-20.31
A	115	42.09	48.33	-21.34
A	116	42.09	47.64	-22.06
A	117	42.09	46.95	-22.78
A	118	42.09	46.26	-23.50
A	119	42.09	46.26	-36.81
A	120	42.09	46.71	-35.92
A	121	42.09	47.16	-35.03
A	122	42.09	47.61	-34.13
A	123	42.09	48.06	-33.24
A	124	42.09	48.51	-32.35
A	125	42.09	48.96	-31.45
A	126	42.09	49.41	-30.56
A	127	42.09	49.86	-29.67
A	128	42.09	50.31	-28.78
A	129	42.09	50.95	-28.00
A	130	42.09	51.64	-27.27
A	131	42.09	52.34	-26.55
A	132	42.09	53.03	-25.83

A	133	41.84	53.99	-24.46
A	134	41.84	54.69	-23.73
A	135	41.84	55.38	-23.01
A	136	41.84	56.07	-22.29
A	137	41.84	56.76	-21.57
A	138	41.84	57.45	-20.84
A	139	41.84	58.14	-20.12
A	140	41.84	58.83	-19.40
A	141	41.84	59.52	-18.68
A	142	41.84	60.22	-17.95
A	143	41.84	60.91	-17.23
A	144	41.84	61.60	-16.51
A	145	41.84	62.29	-15.79
A	146	41.84	62.98	-15.06
A	147	41.84	63.67	-14.34
A	148	41.84	64.36	-13.62
A	149	41.84	65.05	-12.89
A	150	41.84	65.75	-12.17
A	151	41.84	66.44	-11.45
A	152	41.84	67.13	-10.73
A	153	41.84	67.82	-10.00
A	154	41.84	68.51	-9.28
A	155	41.84	69.20	-8.56
A	156	41.84	69.89	-7.84
A	157	41.84	70.58	-7.11
A	158	41.84	71.28	-6.39
A	159	41.84	71.97	-5.67
A	160	41.84	72.66	-4.95
A	161	41.84	73.35	-4.22
A	162	41.84	74.04	-3.50
A	163	41.84	74.73	-2.78
A	164	41.84	75.42	-2.06
A	165	41.84	76.11	-1.33
A	166	41.84	76.81	-0.61
A	167	41.84	77.50	0.11
A	168	41.84	78.19	0.83
A	169	41.84	78.88	1.56
A	170	41.84	79.57	2.28
A	171	42.09	80.91	3.32
A	172	42.09	81.60	4.04
A	173	42.09	82.29	4.76
A	174	42.09	82.98	5.48
A	175	42.09	83.67	6.21
A	176	42.09	84.36	6.93

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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A	177	42.09	85.05	7.65
A	178	28.66	25.43	-51.75
A	179	29.11	25.88	-50.98
A	180	29.56	26.34	-50.21
A	181	30.02	26.79	-49.44
A	182	30.47	27.25	-48.68
A	183	30.93	27.70	-47.91
A	184	31.38	28.15	-47.14
A	185	31.83	28.61	-46.38
A	186	32.29	29.06	-45.61
A	187	32.74	29.51	-44.84
A	188	33.19	29.97	-44.07
A	189	33.65	30.42	-43.31
A	190	34.10	30.87	-42.54
A	191	34.55	31.33	-41.77
A	192	35.01	31.78	-41.01
A	193	35.46	32.23	-40.24
A	194	35.91	32.69	-39.47
A	195	36.37	33.14	-38.70
A	196	36.82	33.60	-37.94
A	197	37.28	34.05	-37.17
A	198	40.39	37.17	-40.86
A	199	39.94	36.71	-41.63
A	200	39.49	36.26	-42.39
A	201	39.03	35.81	-43.16
A	202	38.58	35.35	-43.93
A	203	38.13	34.90	-44.69
A	204	37.67	34.45	-45.46
A	205	37.22	33.99	-46.23
A	206	36.77	33.54	-47.00
A	207	36.31	33.09	-47.76
A	208	35.86	32.63	-48.53
A	209	35.40	32.18	-49.30
A	210	34.95	31.73	-50.06
A	211	34.50	31.27	-50.83
A	212	34.04	30.82	-51.60
A	213	33.59	30.36	-52.37
A	214	33.14	29.91	-53.13
A	215	32.68	29.46	-53.90
A	216	32.23	29.00	-54.67
B	1	36.52	47.11	34.27
B	2	36.52	48.00	33.83
B	3	36.52	48.90	33.38
B	4	36.52	49.79	32.93

B	5	36.52	50.69	32.49
B	6	36.52	51.58	32.04
B	7	36.52	52.48	31.59
B	8	36.52	53.37	31.15
B	9	36.52	54.27	30.70
B	10	36.52	55.16	30.25
B	11	36.52	56.05	29.80
B	12	36.52	56.95	29.36
B	13	36.84	58.48	28.67
B	14	36.84	59.48	28.57
B	15	36.84	60.48	28.48
B	16	36.84	61.47	28.39
B	17	36.84	62.47	28.30
B	18	36.84	63.46	28.20
B	19	36.84	64.46	28.11
B	20	36.84	65.45	28.02
B	21	36.84	66.45	27.92
B	22	36.84	67.44	27.83
B	23	36.84	68.44	27.74
B	24	36.84	69.44	27.64
B	25	36.84	70.43	27.55
B	26	36.84	71.43	27.46
B	27	36.84	72.42	27.36
B	28	36.52	73.68	27.56
B	29	36.52	74.68	27.47
B	30	36.52	75.67	27.37
B	31	36.52	76.67	27.28
B	32	36.52	77.66	27.19
B	33	36.52	44.56	23.95
B	34	36.52	45.51	23.64
B	35	36.52	46.46	23.34
B	36	36.52	47.41	23.04
B	37	36.52	48.37	22.73
B	38	36.52	49.32	22.43
B	39	36.52	50.27	22.13
B	40	36.52	51.23	21.82
B	41	36.52	52.21	21.68
B	42	36.52	53.21	21.58
B	43	36.52	54.20	21.49
B	44	36.52	55.20	21.40
B	45	36.52	56.20	21.30
B	46	36.84	57.81	21.45
B	47	36.84	58.80	21.36
B	48	36.84	59.80	21.26

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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B	49	36.84	60.80	21.17
B	50	36.84	61.79	21.08
B	51	36.84	62.79	20.98
B	52	36.84	63.78	20.89
B	53	36.84	64.78	20.80
B	54	36.84	65.77	20.70
B	55	36.84	66.77	20.61
B	56	36.84	67.76	20.52
B	57	36.84	68.76	20.42
B	58	36.84	69.76	20.33
B	59	36.84	70.75	20.24
B	60	36.84	71.75	20.14
B	61	36.52	72.95	19.72
B	62	36.52	73.94	19.63
B	63	36.52	74.94	19.53
B	64	36.52	75.93	19.44
B	65	36.52	76.93	19.35
B	66	36.09	78.70	18.33
B	67	36.09	78.70	17.33
B	68	36.09	78.70	16.33
B	69	36.09	78.70	15.33
B	70	36.09	78.70	14.33
B	71	36.09	78.70	13.33
B	72	36.59	78.88	10.79
B	73	36.59	78.19	10.07
B	74	36.59	77.50	9.35
B	75	36.59	76.80	8.62
B	76	36.59	76.11	7.90
B	77	36.84	75.24	6.43
B	78	36.84	74.54	5.71
B	79	36.84	73.85	4.98
B	80	36.84	73.16	4.26
B	81	36.84	72.47	3.54
B	82	36.84	71.78	2.81
B	83	36.84	71.09	2.09
B	84	36.84	70.40	1.37
B	85	36.84	69.71	0.65
B	86	36.84	69.01	-0.08
B	87	36.84	68.32	-0.80
B	88	36.84	67.63	-1.52
B	89	36.84	66.94	-2.24
B	90	36.84	66.25	-2.97
B	91	36.84	65.56	-3.69
B	92	36.84	64.87	-4.41

B	93	36.84	64.18	-5.13
B	94	36.84	63.48	-5.86
B	95	36.84	62.79	-6.58
B	96	36.84	62.10	-7.30
B	97	36.84	61.41	-8.02
B	98	36.84	60.72	-8.75
B	99	36.84	60.03	-9.47
B	100	36.84	59.34	-10.19
B	101	36.84	58.65	-10.91
B	102	36.84	57.95	-11.64
B	103	36.84	57.26	-12.36
B	104	36.84	56.57	-13.08
B	105	36.84	55.88	-13.81
B	106	36.84	55.19	-14.53
B	107	36.84	54.50	-15.25
B	108	36.84	53.81	-15.97
B	109	36.84	53.12	-16.70
B	110	36.84	52.42	-17.42
B	111	36.84	51.73	-18.14
B	112	36.84	51.04	-18.86
B	113	36.84	50.35	-19.59
B	114	36.84	49.66	-20.31
B	115	36.59	48.33	-21.34
B	116	36.59	47.64	-22.06
B	117	36.59	46.95	-22.78
B	118	36.59	46.26	-23.50
B	119	36.59	46.26	-36.81
B	120	36.59	46.71	-35.92
B	121	36.59	47.16	-35.03
B	122	36.59	47.61	-34.13
B	123	36.59	48.06	-33.24
B	124	36.59	48.51	-32.35
B	125	36.59	48.96	-31.45
B	126	36.59	49.41	-30.56
B	127	36.59	49.86	-29.67
B	128	36.59	50.31	-28.78
B	129	36.59	50.95	-28.00
B	130	36.59	51.64	-27.27
B	131	36.59	52.34	-26.55
B	132	36.59	53.03	-25.83
B	133	36.84	53.99	-24.46
B	134	36.84	54.69	-23.73
B	135	36.84	55.38	-23.01
B	136	36.84	56.07	-22.29

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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B	137	36.84	56.76	-21.57
B	138	36.84	57.45	-20.84
B	139	36.84	58.14	-20.12
B	140	36.84	58.83	-19.40
B	141	36.84	59.52	-18.68
B	142	36.84	60.22	-17.95
B	143	36.84	60.91	-17.23
B	144	36.84	61.60	-16.51
B	145	36.84	62.29	-15.79
B	146	36.84	62.98	-15.06
B	147	36.84	63.67	-14.34
B	148	36.84	64.36	-13.62
B	149	36.84	65.05	-12.89
B	150	36.84	65.75	-12.17
B	151	36.84	66.44	-11.45
B	152	36.84	67.13	-10.73
B	153	36.84	67.82	-10.00
B	154	36.84	68.51	-9.28
B	155	36.84	69.20	-8.56
B	156	36.84	69.89	-7.84
B	157	36.84	70.58	-7.11
B	158	36.84	71.28	-6.39
B	159	36.84	71.97	-5.67
B	160	36.84	72.66	-4.95
B	161	36.84	73.35	-4.22
B	162	36.84	74.04	-3.50
B	163	36.84	74.73	-2.78
B	164	36.84	75.42	-2.06
B	165	36.84	76.11	-1.33
B	166	36.84	76.81	-0.61
B	167	36.84	77.50	0.11
B	168	36.84	78.19	0.83
B	169	36.84	78.88	1.56
B	170	36.84	79.57	2.28
B	171	36.59	80.91	3.32
B	172	36.59	81.60	4.04
B	173	36.59	82.29	4.76
B	174	36.59	82.98	5.48
B	175	36.59	83.67	6.21
B	176	36.59	84.36	6.93
B	177	36.59	85.05	7.65
B	178	25.43	28.66	-51.75
B	179	25.88	29.11	-50.98
B	180	26.34	29.56	-50.21

B	181	26.79	30.02	-49.44
B	182	27.25	30.47	-48.68
B	183	27.70	30.93	-47.91
B	184	28.15	31.38	-47.14
B	185	28.61	31.83	-46.38
B	186	29.06	32.29	-45.61
B	187	29.51	32.74	-44.84
B	188	29.97	33.19	-44.07
B	189	30.42	33.65	-43.31
B	190	30.87	34.10	-42.54
B	191	31.33	34.55	-41.77
B	192	31.78	35.01	-41.01
B	193	32.23	35.46	-40.24
B	194	32.69	35.91	-39.47
B	195	33.14	36.37	-38.70
B	196	33.60	36.82	-37.94
B	197	34.05	37.28	-37.17
B	198	37.17	40.39	-40.86
B	199	36.71	39.94	-41.63
B	200	36.26	39.49	-42.39
B	201	35.81	39.03	-43.16
B	202	35.35	38.58	-43.93
B	203	34.90	38.13	-44.69
B	204	34.45	37.67	-45.46
B	205	33.99	37.22	-46.23
B	206	33.54	36.77	-47.00
B	207	33.09	36.31	-47.76
B	208	32.63	35.86	-48.53
B	209	32.18	35.40	-49.30
B	210	31.73	34.95	-50.06
B	211	31.27	34.50	-50.83
B	212	30.82	34.04	-51.60
B	213	30.36	33.59	-52.37
B	214	29.91	33.14	-53.13
B	215	29.46	32.68	-53.90
B	216	29.00	32.23	-54.67
C	1	-36.52	47.11	34.27
C	2	-36.52	48.00	33.83
C	3	-36.52	48.90	33.38
C	4	-36.52	49.79	32.93
C	5	-36.52	50.69	32.49
C	6	-36.52	51.58	32.04
C	7	-36.52	52.48	31.59
C	8	-36.52	53.37	31.15

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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C	9	-36.52	54.27	30.70
C	10	-36.52	55.16	30.25
C	11	-36.52	56.05	29.80
C	12	-36.52	56.95	29.36
C	13	-36.84	58.48	28.67
C	14	-36.84	59.48	28.57
C	15	-36.84	60.48	28.48
C	16	-36.84	61.47	28.39
C	17	-36.84	62.47	28.30
C	18	-36.84	63.46	28.20
C	19	-36.84	64.46	28.11
C	20	-36.84	65.45	28.02
C	21	-36.84	66.45	27.92
C	22	-36.84	67.44	27.83
C	23	-36.84	68.44	27.74
C	24	-36.84	69.44	27.64
C	25	-36.84	70.43	27.55
C	26	-36.84	71.43	27.46
C	27	-36.84	72.42	27.36
C	28	-36.52	73.68	27.56
C	29	-36.52	74.68	27.47
C	30	-36.52	75.67	27.37
C	31	-36.52	76.67	27.28
C	32	-36.52	77.66	27.19
C	33	-36.52	44.56	23.95
C	34	-36.52	45.51	23.64
C	35	-36.52	46.46	23.34
C	36	-36.52	47.41	23.04
C	37	-36.52	48.37	22.73
C	38	-36.52	49.32	22.43
C	39	-36.52	50.27	22.13
C	40	-36.52	51.23	21.82
C	41	-36.52	52.21	21.68
C	42	-36.52	53.21	21.58
C	43	-36.52	54.20	21.49
C	44	-36.52	55.20	21.40
C	45	-36.52	56.20	21.30
C	46	-36.84	57.81	21.45
C	47	-36.84	58.80	21.36
C	48	-36.84	59.80	21.26
C	49	-36.84	60.80	21.17
C	50	-36.84	61.79	21.08
C	51	-36.84	62.79	20.98
C	52	-36.84	63.78	20.89

C	53	-36.84	64.78	20.80
C	54	-36.84	65.77	20.70
C	55	-36.84	66.77	20.61
C	56	-36.84	67.76	20.52
C	57	-36.84	68.76	20.42
C	58	-36.84	69.76	20.33
C	59	-36.84	70.75	20.24
C	60	-36.84	71.75	20.14
C	61	-36.52	72.95	19.72
C	62	-36.52	73.94	19.63
C	63	-36.52	74.94	19.53
C	64	-36.52	75.93	19.44
C	65	-36.52	76.93	19.35
C	66	-36.09	78.70	18.33
C	67	-36.09	78.70	17.33
C	68	-36.09	78.70	16.33
C	69	-36.09	78.70	15.33
C	70	-36.09	78.70	14.33
C	71	-36.09	78.70	13.33
C	72	-36.59	78.88	10.79
C	73	-36.59	78.19	10.07
C	74	-36.59	77.50	9.35
C	75	-36.59	76.80	8.62
C	76	-36.59	76.11	7.90
C	77	-36.84	75.24	6.43
C	78	-36.84	74.54	5.71
C	79	-36.84	73.85	4.98
C	80	-36.84	73.16	4.26
C	81	-36.84	72.47	3.54
C	82	-36.84	71.78	2.81
C	83	-36.84	71.09	2.09
C	84	-36.84	70.40	1.37
C	85	-36.84	69.71	0.65
C	86	-36.84	69.01	-0.08
C	87	-36.84	68.32	-0.80
C	88	-36.84	67.63	-1.52
C	89	-36.84	66.94	-2.24
C	90	-36.84	66.25	-2.97
C	91	-36.84	65.56	-3.69
C	92	-36.84	64.87	-4.41
C	93	-36.84	64.18	-5.13
C	94	-36.84	63.48	-5.86
C	95	-36.84	62.79	-6.58
C	96	-36.84	62.10	-7.30

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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C	97	-36.84	61.41	-8.02
C	98	-36.84	60.72	-8.75
C	99	-36.84	60.03	-9.47
C	100	-36.84	59.34	-10.19
C	101	-36.84	58.65	-10.91
C	102	-36.84	57.95	-11.64
C	103	-36.84	57.26	-12.36
C	104	-36.84	56.57	-13.08
C	105	-36.84	55.88	-13.81
C	106	-36.84	55.19	-14.53
C	107	-36.84	54.50	-15.25
C	108	-36.84	53.81	-15.97
C	109	-36.84	53.12	-16.70
C	110	-36.84	52.42	-17.42
C	111	-36.84	51.73	-18.14
C	112	-36.84	51.04	-18.86
C	113	-36.84	50.35	-19.59
C	114	-36.84	49.66	-20.31
C	115	-36.59	48.33	-21.34
C	116	-36.59	47.64	-22.06
C	117	-36.59	46.95	-22.78
C	118	-36.59	46.26	-23.50
C	119	-36.59	46.26	-36.81
C	120	-36.59	46.71	-35.92
C	121	-36.59	47.16	-35.03
C	122	-36.59	47.61	-34.13
C	123	-36.59	48.06	-33.24
C	124	-36.59	48.51	-32.35
C	125	-36.59	48.96	-31.45
C	126	-36.59	49.41	-30.56
C	127	-36.59	49.86	-29.67
C	128	-36.59	50.31	-28.78
C	129	-36.59	50.95	-28.00
C	130	-36.59	51.64	-27.27
C	131	-36.59	52.34	-26.55
C	132	-36.59	53.03	-25.83
C	133	-36.84	53.99	-24.46
C	134	-36.84	54.69	-23.73
C	135	-36.84	55.38	-23.01
C	136	-36.84	56.07	-22.29
C	137	-36.84	56.76	-21.57
C	138	-36.84	57.45	-20.84
C	139	-36.84	58.14	-20.12
C	140	-36.84	58.83	-19.40

C	141	-36.84	59.52	-18.68
C	142	-36.84	60.22	-17.95
C	143	-36.84	60.91	-17.23
C	144	-36.84	61.60	-16.51
C	145	-36.84	62.29	-15.79
C	146	-36.84	62.98	-15.06
C	147	-36.84	63.67	-14.34
C	148	-36.84	64.36	-13.62
C	149	-36.84	65.05	-12.89
C	150	-36.84	65.75	-12.17
C	151	-36.84	66.44	-11.45
C	152	-36.84	67.13	-10.73
C	153	-36.84	67.82	-10.00
C	154	-36.84	68.51	-9.28
C	155	-36.84	69.20	-8.56
C	156	-36.84	69.89	-7.84
C	157	-36.84	70.58	-7.11
C	158	-36.84	71.28	-6.39
C	159	-36.84	71.97	-5.67
C	160	-36.84	72.66	-4.95
C	161	-36.84	73.35	-4.22
C	162	-36.84	74.04	-3.50
C	163	-36.84	74.73	-2.78
C	164	-36.84	75.42	-2.06
C	165	-36.84	76.11	-1.33
C	166	-36.84	76.81	-0.61
C	167	-36.84	77.50	0.11
C	168	-36.84	78.19	0.83
C	169	-36.84	78.88	1.56
C	170	-36.84	79.57	2.28
C	171	-36.59	80.91	3.32
C	172	-36.59	81.60	4.04
C	173	-36.59	82.29	4.76
C	174	-36.59	82.98	5.48
C	175	-36.59	83.67	6.21
C	176	-36.59	84.36	6.93
C	177	-36.59	85.05	7.65
C	178	-25.43	28.66	-51.75
C	179	-25.88	29.11	-50.98
C	180	-26.34	29.56	-50.21
C	181	-26.79	30.02	-49.44
C	182	-27.25	30.47	-48.68
C	183	-27.70	30.93	-47.91
C	184	-28.15	31.38	-47.14

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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C	185	-28.61	31.83	-46.38
C	186	-29.06	32.29	-45.61
C	187	-29.51	32.74	-44.84
C	188	-29.97	33.19	-44.07
C	189	-30.42	33.65	-43.31
C	190	-30.87	34.10	-42.54
C	191	-31.33	34.55	-41.77
C	192	-31.78	35.01	-41.01
C	193	-32.23	35.46	-40.24
C	194	-32.69	35.91	-39.47
C	195	-33.14	36.37	-38.70
C	196	-33.60	36.82	-37.94
C	197	-34.05	37.28	-37.17
C	198	-37.17	40.39	-40.86
C	199	-36.71	39.94	-41.63
C	200	-36.26	39.49	-42.39
C	201	-35.81	39.03	-43.16
C	202	-35.35	38.58	-43.93
C	203	-34.90	38.13	-44.69
C	204	-34.45	37.67	-45.46
C	205	-33.99	37.22	-46.23
C	206	-33.54	36.77	-47.00
C	207	-33.09	36.31	-47.76
C	208	-32.63	35.86	-48.53
C	209	-32.18	35.40	-49.30
C	210	-31.73	34.95	-50.06
C	211	-31.27	34.50	-50.83
C	212	-30.82	34.04	-51.60
C	213	-30.36	33.59	-52.37
C	214	-29.91	33.14	-53.13
C	215	-29.46	32.68	-53.90
C	216	-29.00	32.23	-54.67
D	1	-42.15	47.11	34.27
D	2	-42.15	48.00	33.83
D	3	-42.15	48.90	33.38
D	4	-42.15	49.79	32.93
D	5	-42.15	50.69	32.49
D	6	-42.15	51.58	32.04
D	7	-42.15	52.48	31.59
D	8	-42.15	53.37	31.15
D	9	-42.15	54.27	30.70
D	10	-42.15	55.16	30.25
D	11	-42.15	56.05	29.80
D	12	-42.15	56.95	29.36

D	13	-41.84	58.48	28.67
D	14	-41.84	59.48	28.57
D	15	-41.84	60.48	28.48
D	16	-41.84	61.47	28.39
D	17	-41.84	62.47	28.30
D	18	-41.84	63.46	28.20
D	19	-41.84	64.46	28.11
D	20	-41.84	65.45	28.02
D	21	-41.84	66.45	27.92
D	22	-41.84	67.44	27.83
D	23	-41.84	68.44	27.74
D	24	-41.84	69.44	27.64
D	25	-41.84	70.43	27.55
D	26	-41.84	71.43	27.46
D	27	-41.84	72.42	27.36
D	28	-42.15	73.68	27.56
D	29	-42.15	74.68	27.47
D	30	-42.15	75.67	27.37
D	31	-42.15	76.67	27.28
D	32	-42.15	77.66	27.19
D	33	-42.15	44.56	23.95
D	34	-42.15	45.51	23.64
D	35	-42.15	46.46	23.34
D	36	-42.15	47.41	23.04
D	37	-42.15	48.37	22.73
D	38	-42.15	49.32	22.43
D	39	-42.15	50.27	22.13
D	40	-42.15	51.23	21.82
D	41	-42.15	52.21	21.68
D	42	-42.15	53.21	21.58
D	43	-42.15	54.20	21.49
D	44	-42.15	55.20	21.40
D	45	-42.15	56.20	21.30
D	46	-41.84	57.81	21.45
D	47	-41.84	58.80	21.36
D	48	-41.84	59.80	21.26
D	49	-41.84	60.80	21.17
D	50	-41.84	61.79	21.08
D	51	-41.84	62.79	20.98
D	52	-41.84	63.78	20.89
D	53	-41.84	64.78	20.80
D	54	-41.84	65.77	20.70
D	55	-41.84	66.77	20.61
D	56	-41.84	67.76	20.52

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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D	57	-41.84	68.76	20.42
D	58	-41.84	69.76	20.33
D	59	-41.84	70.75	20.24
D	60	-41.84	71.75	20.14
D	61	-42.15	72.95	19.72
D	62	-42.15	73.94	19.63
D	63	-42.15	74.94	19.53
D	64	-42.15	75.93	19.44
D	65	-42.15	76.93	19.35
D	66	-42.59	78.70	18.33
D	67	-42.59	78.70	17.33
D	68	-42.59	78.70	16.33
D	69	-42.59	78.70	15.33
D	70	-42.59	78.70	14.33
D	71	-42.59	78.70	13.33
D	72	-42.09	78.88	10.79
D	73	-42.09	78.19	10.07
D	74	-42.09	77.50	9.35
D	75	-42.09	76.80	8.62
D	76	-42.09	76.11	7.90
D	77	-41.84	75.24	6.43
D	78	-41.84	74.54	5.71
D	79	-41.84	73.85	4.98
D	80	-41.84	73.16	4.26
D	81	-41.84	72.47	3.54
D	82	-41.84	71.78	2.81
D	83	-41.84	71.09	2.09
D	84	-41.84	70.40	1.37
D	85	-41.84	69.71	0.65
D	86	-41.84	69.01	-0.08
D	87	-41.84	68.32	-0.80
D	88	-41.84	67.63	-1.52
D	89	-41.84	66.94	-2.24
D	90	-41.84	66.25	-2.97
D	91	-41.84	65.56	-3.69
D	92	-41.84	64.87	-4.41
D	93	-41.84	64.18	-5.13
D	94	-41.84	63.48	-5.86
D	95	-41.84	62.79	-6.58
D	96	-41.84	62.10	-7.30
D	97	-41.84	61.41	-8.02
D	98	-41.84	60.72	-8.75
D	99	-41.84	60.03	-9.47
D	100	-41.84	59.34	-10.19

D	101	-41.84	58.65	-10.91
D	102	-41.84	57.95	-11.64
D	103	-41.84	57.26	-12.36
D	104	-41.84	56.57	-13.08
D	105	-41.84	55.88	-13.81
D	106	-41.84	55.19	-14.53
D	107	-41.84	54.50	-15.25
D	108	-41.84	53.81	-15.97
D	109	-41.84	53.12	-16.70
D	110	-41.84	52.42	-17.42
D	111	-41.84	51.73	-18.14
D	112	-41.84	51.04	-18.86
D	113	-41.84	50.35	-19.59
D	114	-41.84	49.66	-20.31
D	115	-42.09	48.33	-21.34
D	116	-42.09	47.64	-22.06
D	117	-42.09	46.95	-22.78
D	118	-42.09	46.26	-23.50
D	119	-42.09	46.26	-36.81
D	120	-42.09	46.71	-35.92
D	121	-42.09	47.16	-35.03
D	122	-42.09	47.61	-34.13
D	123	-42.09	48.06	-33.24
D	124	-42.09	48.51	-32.35
D	125	-42.09	48.96	-31.45
D	126	-42.09	49.41	-30.56
D	127	-42.09	49.86	-29.67
D	128	-42.09	50.31	-28.78
D	129	-42.09	50.95	-28.00
D	130	-42.09	51.64	-27.27
D	131	-42.09	52.34	-26.55
D	132	-42.09	53.03	-25.83
D	133	-41.84	53.99	-24.46
D	134	-41.84	54.69	-23.73
D	135	-41.84	55.38	-23.01
D	136	-41.84	56.07	-22.29
D	137	-41.84	56.76	-21.57
D	138	-41.84	57.45	-20.84
D	139	-41.84	58.14	-20.12
D	140	-41.84	58.83	-19.40
D	141	-41.84	59.52	-18.68
D	142	-41.84	60.22	-17.95
D	143	-41.84	60.91	-17.23
D	144	-41.84	61.60	-16.51

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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D	145	-41.84	62.29	-15.79
D	146	-41.84	62.98	-15.06
D	147	-41.84	63.67	-14.34
D	148	-41.84	64.36	-13.62
D	149	-41.84	65.05	-12.89
D	150	-41.84	65.75	-12.17
D	151	-41.84	66.44	-11.45
D	152	-41.84	67.13	-10.73
D	153	-41.84	67.82	-10.00
D	154	-41.84	68.51	-9.28
D	155	-41.84	69.20	-8.56
D	156	-41.84	69.89	-7.84
D	157	-41.84	70.58	-7.11
D	158	-41.84	71.28	-6.39
D	159	-41.84	71.97	-5.67
D	160	-41.84	72.66	-4.95
D	161	-41.84	73.35	-4.22
D	162	-41.84	74.04	-3.50
D	163	-41.84	74.73	-2.78
D	164	-41.84	75.42	-2.06
D	165	-41.84	76.11	-1.33
D	166	-41.84	76.81	-0.61
D	167	-41.84	77.50	0.11
D	168	-41.84	78.19	0.83
D	169	-41.84	78.88	1.56
D	170	-41.84	79.57	2.28
D	171	-42.09	80.91	3.32
D	172	-42.09	81.60	4.04
D	173	-42.09	82.29	4.76
D	174	-42.09	82.98	5.48
D	175	-42.09	83.67	6.21
D	176	-42.09	84.36	6.93
D	177	-42.09	85.05	7.65
D	178	-28.66	25.43	-51.75
D	179	-29.11	25.88	-50.98
D	180	-29.56	26.34	-50.21
D	181	-30.02	26.79	-49.44
D	182	-30.47	27.25	-48.68
D	183	-30.93	27.70	-47.91
D	184	-31.38	28.15	-47.14
D	185	-31.83	28.61	-46.38
D	186	-32.29	29.06	-45.61
D	187	-32.74	29.51	-44.84
D	188	-33.19	29.97	-44.07

D	189	-33.65	30.42	-43.31
D	190	-34.10	30.87	-42.54
D	191	-34.55	31.33	-41.77
D	192	-35.01	31.78	-41.01
D	193	-35.46	32.23	-40.24
D	194	-35.91	32.69	-39.47
D	195	-36.37	33.14	-38.70
D	196	-36.82	33.60	-37.94
D	197	-37.28	34.05	-37.17
D	198	-40.39	37.17	-40.86
D	199	-39.94	36.71	-41.63
D	200	-39.49	36.26	-42.39
D	201	-39.03	35.81	-43.16
D	202	-38.58	35.35	-43.93
D	203	-38.13	34.90	-44.69
D	204	-37.67	34.45	-45.46
D	205	-37.22	33.99	-46.23
D	206	-36.77	33.54	-47.00
D	207	-36.31	33.09	-47.76
D	208	-35.86	32.63	-48.53
D	209	-35.40	32.18	-49.30
D	210	-34.95	31.73	-50.06
D	211	-34.50	31.27	-50.83
D	212	-34.04	30.82	-51.60
D	213	-33.59	30.36	-52.37
D	214	-33.14	29.91	-53.13
D	215	-32.68	29.46	-53.90
D	216	-32.23	29.00	-54.67
E	1	42.15	-47.11	34.27
E	2	42.15	-48.00	33.83
E	3	42.15	-48.90	33.38
E	4	42.15	-49.79	32.93
E	5	42.15	-50.69	32.49
E	6	42.15	-51.58	32.04
E	7	42.15	-52.48	31.59
E	8	42.15	-53.37	31.15
E	9	42.15	-54.27	30.70
E	10	42.15	-55.16	30.25
E	11	42.15	-56.05	29.80
E	12	42.15	-56.95	29.36
E	13	41.84	-58.48	28.67
E	14	41.84	-59.48	28.57
E	15	41.84	-60.48	28.48
E	16	41.84	-61.47	28.39

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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E	17	41.84	-62.47	28.30
E	18	41.84	-63.46	28.20
E	19	41.84	-64.46	28.11
E	20	41.84	-65.45	28.02
E	21	41.84	-66.45	27.92
E	22	41.84	-67.44	27.83
E	23	41.84	-68.44	27.74
E	24	41.84	-69.44	27.64
E	25	41.84	-70.43	27.55
E	26	41.84	-71.43	27.46
E	27	41.84	-72.42	27.36
E	28	42.15	-73.68	27.56
E	29	42.15	-74.68	27.47
E	30	42.15	-75.67	27.37
E	31	42.15	-76.67	27.28
E	32	42.15	-77.66	27.19
E	33	42.15	-44.56	23.95
E	34	42.15	-45.51	23.64
E	35	42.15	-46.46	23.34
E	36	42.15	-47.41	23.04
E	37	42.15	-48.37	22.73
E	38	42.15	-49.32	22.43
E	39	42.15	-50.27	22.13
E	40	42.15	-51.23	21.82
E	41	42.15	-52.21	21.68
E	42	42.15	-53.21	21.58
E	43	42.15	-54.20	21.49
E	44	42.15	-55.20	21.40
E	45	42.15	-56.20	21.30
E	46	41.84	-57.81	21.45
E	47	41.84	-58.80	21.36
E	48	41.84	-59.80	21.26
E	49	41.84	-60.80	21.17
E	50	41.84	-61.79	21.08
E	51	41.84	-62.79	20.98
E	52	41.84	-63.78	20.89
E	53	41.84	-64.78	20.80
E	54	41.84	-65.77	20.70
E	55	41.84	-66.77	20.61
E	56	41.84	-67.76	20.52
E	57	41.84	-68.76	20.42
E	58	41.84	-69.76	20.33
E	59	41.84	-70.75	20.24
E	60	41.84	-71.75	20.14

E	61	42.15	-72.95	19.72
E	62	42.15	-73.94	19.63
E	63	42.15	-74.94	19.53
E	64	42.15	-75.93	19.44
E	65	42.15	-76.93	19.35
E	66	42.59	-78.70	18.33
E	67	42.59	-78.70	17.33
E	68	42.59	-78.70	16.33
E	69	42.59	-78.70	15.33
E	70	42.59	-78.70	14.33
E	71	42.59	-78.70	13.33
E	72	42.09	-78.88	10.79
E	73	42.09	-78.19	10.07
E	74	42.09	-77.50	9.35
E	75	42.09	-76.80	8.62
E	76	42.09	-76.11	7.90
E	77	41.84	-75.24	6.43
E	78	41.84	-74.54	5.71
E	79	41.84	-73.85	4.98
E	80	41.84	-73.16	4.26
E	81	41.84	-72.47	3.54
E	82	41.84	-71.78	2.81
E	83	41.84	-71.09	2.09
E	84	41.84	-70.40	1.37
E	85	41.84	-69.71	0.65
E	86	41.84	-69.01	-0.08
E	87	41.84	-68.32	-0.80
E	88	41.84	-67.63	-1.52
E	89	41.84	-66.94	-2.24
E	90	41.84	-66.25	-2.97
E	91	41.84	-65.56	-3.69
E	92	41.84	-64.87	-4.41
E	93	41.84	-64.18	-5.13
E	94	41.84	-63.48	-5.86
E	95	41.84	-62.79	-6.58
E	96	41.84	-62.10	-7.30
E	97	41.84	-61.41	-8.02
E	98	41.84	-60.72	-8.75
E	99	41.84	-60.03	-9.47
E	100	41.84	-59.34	-10.19
E	101	41.84	-58.65	-10.91
E	102	41.84	-57.95	-11.64
E	103	41.84	-57.26	-12.36
E	104	41.84	-56.57	-13.08

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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E	105	41.84	-55.88	-13.81
E	106	41.84	-55.19	-14.53
E	107	41.84	-54.50	-15.25
E	108	41.84	-53.81	-15.97
E	109	41.84	-53.12	-16.70
E	110	41.84	-52.42	-17.42
E	111	41.84	-51.73	-18.14
E	112	41.84	-51.04	-18.86
E	113	41.84	-50.35	-19.59
E	114	41.84	-49.66	-20.31
E	115	42.09	-48.33	-21.34
E	116	42.09	-47.64	-22.06
E	117	42.09	-46.95	-22.78
E	118	42.09	-46.26	-23.50
E	119	42.09	-46.26	-36.81
E	120	42.09	-46.71	-35.92
E	121	42.09	-47.16	-35.03
E	122	42.09	-47.61	-34.13
E	123	42.09	-48.06	-33.24
E	124	42.09	-48.51	-32.35
E	125	42.09	-48.96	-31.45
E	126	42.09	-49.41	-30.56
E	127	42.09	-49.86	-29.67
E	128	42.09	-50.31	-28.78
E	129	42.09	-50.95	-28.00
E	130	42.09	-51.64	-27.27
E	131	42.09	-52.34	-26.55
E	132	42.09	-53.03	-25.83
E	133	41.84	-53.99	-24.46
E	134	41.84	-54.69	-23.73
E	135	41.84	-55.38	-23.01
E	136	41.84	-56.07	-22.29
E	137	41.84	-56.76	-21.57
E	138	41.84	-57.45	-20.84
E	139	41.84	-58.14	-20.12
E	140	41.84	-58.83	-19.40
E	141	41.84	-59.52	-18.68
E	142	41.84	-60.22	-17.95
E	143	41.84	-60.91	-17.23
E	144	41.84	-61.60	-16.51
E	145	41.84	-62.29	-15.79
E	146	41.84	-62.98	-15.06
E	147	41.84	-63.67	-14.34
E	148	41.84	-64.36	-13.62

E	149	41.84	-65.05	-12.89
E	150	41.84	-65.75	-12.17
E	151	41.84	-66.44	-11.45
E	152	41.84	-67.13	-10.73
E	153	41.84	-67.82	-10.00
E	154	41.84	-68.51	-9.28
E	155	41.84	-69.20	-8.56
E	156	41.84	-69.89	-7.84
E	157	41.84	-70.58	-7.11
E	158	41.84	-71.28	-6.39
E	159	41.84	-71.97	-5.67
E	160	41.84	-72.66	-4.95
E	161	41.84	-73.35	-4.22
E	162	41.84	-74.04	-3.50
E	163	41.84	-74.73	-2.78
E	164	41.84	-75.42	-2.06
E	165	41.84	-76.11	-1.33
E	166	41.84	-76.81	-0.61
E	167	41.84	-77.50	0.11
E	168	41.84	-78.19	0.83
E	169	41.84	-78.88	1.56
E	170	41.84	-79.57	2.28
E	171	42.09	-80.91	3.32
E	172	42.09	-81.60	4.04
E	173	42.09	-82.29	4.76
E	174	42.09	-82.98	5.48
E	175	42.09	-83.67	6.21
E	176	42.09	-84.36	6.93
E	177	42.09	-85.05	7.65
E	178	28.66	-25.43	-51.75
E	179	29.11	-25.88	-50.98
E	180	29.56	-26.34	-50.21
E	181	30.02	-26.79	-49.44
E	182	30.47	-27.25	-48.68
E	183	30.93	-27.70	-47.91
E	184	31.38	-28.15	-47.14
E	185	31.83	-28.61	-46.38
E	186	32.29	-29.06	-45.61
E	187	32.74	-29.51	-44.84
E	188	33.19	-29.97	-44.07
E	189	33.65	-30.42	-43.31
E	190	34.10	-30.87	-42.54
E	191	34.55	-31.33	-41.77
E	192	35.01	-31.78	-41.01

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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E	193	35.46	-32.23	-40.24
E	194	35.91	-32.69	-39.47
E	195	36.37	-33.14	-38.70
E	196	36.82	-33.60	-37.94
E	197	37.28	-34.05	-37.17
E	198	40.39	-37.17	-40.86
E	199	39.94	-36.71	-41.63
E	200	39.49	-36.26	-42.39
E	201	39.03	-35.81	-43.16
E	202	38.58	-35.35	-43.93
E	203	38.13	-34.90	-44.69
E	204	37.67	-34.45	-45.46
E	205	37.22	-33.99	-46.23
E	206	36.77	-33.54	-47.00
E	207	36.31	-33.09	-47.76
E	208	35.86	-32.63	-48.53
E	209	35.40	-32.18	-49.30
E	210	34.95	-31.73	-50.06
E	211	34.50	-31.27	-50.83
E	212	34.04	-30.82	-51.60
E	213	33.59	-30.36	-52.37
E	214	33.14	-29.91	-53.13
E	215	32.68	-29.46	-53.90
E	216	32.23	-29.00	-54.67
F	1	36.52	-47.11	34.27
F	2	36.52	-48.00	33.83
F	3	36.52	-48.90	33.38
F	4	36.52	-49.79	32.93
F	5	36.52	-50.69	32.49
F	6	36.52	-51.58	32.04
F	7	36.52	-52.48	31.59
F	8	36.52	-53.37	31.15
F	9	36.52	-54.27	30.70
F	10	36.52	-55.16	30.25
F	11	36.52	-56.05	29.80
F	12	36.52	-56.95	29.36
F	13	36.84	-58.48	28.67
F	14	36.84	-59.48	28.57
F	15	36.84	-60.48	28.48
F	16	36.84	-61.47	28.39
F	17	36.84	-62.47	28.30
F	18	36.84	-63.46	28.20
F	19	36.84	-64.46	28.11
F	20	36.84	-65.45	28.02

F	21	36.84	-66.45	27.92
F	22	36.84	-67.44	27.83
F	23	36.84	-68.44	27.74
F	24	36.84	-69.44	27.64
F	25	36.84	-70.43	27.55
F	26	36.84	-71.43	27.46
F	27	36.84	-72.42	27.36
F	28	36.52	-73.68	27.56
F	29	36.52	-74.68	27.47
F	30	36.52	-75.67	27.37
F	31	36.52	-76.67	27.28
F	32	36.52	-77.66	27.19
F	33	36.52	-44.56	23.95
F	34	36.52	-45.51	23.64
F	35	36.52	-46.46	23.34
F	36	36.52	-47.41	23.04
F	37	36.52	-48.37	22.73
F	38	36.52	-49.32	22.43
F	39	36.52	-50.27	22.13
F	40	36.52	-51.23	21.82
F	41	36.52	-52.21	21.68
F	42	36.52	-53.21	21.58
F	43	36.52	-54.20	21.49
F	44	36.52	-55.20	21.40
F	45	36.52	-56.20	21.30
F	46	36.84	-57.81	21.45
F	47	36.84	-58.80	21.36
F	48	36.84	-59.80	21.26
F	49	36.84	-60.80	21.17
F	50	36.84	-61.79	21.08
F	51	36.84	-62.79	20.98
F	52	36.84	-63.78	20.89
F	53	36.84	-64.78	20.80
F	54	36.84	-65.77	20.70
F	55	36.84	-66.77	20.61
F	56	36.84	-67.76	20.52
F	57	36.84	-68.76	20.42
F	58	36.84	-69.76	20.33
F	59	36.84	-70.75	20.24
F	60	36.84	-71.75	20.14
F	61	36.52	-72.95	19.72
F	62	36.52	-73.94	19.63
F	63	36.52	-74.94	19.53
F	64	36.52	-75.93	19.44

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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F	65	36.52	-76.93	19.35
F	66	36.09	-78.70	18.33
F	67	36.09	-78.70	17.33
F	68	36.09	-78.70	16.33
F	69	36.09	-78.70	15.33
F	70	36.09	-78.70	14.33
F	71	36.09	-78.70	13.33
F	72	36.59	-78.88	10.79
F	73	36.59	-78.19	10.07
F	74	36.59	-77.50	9.35
F	75	36.59	-76.80	8.62
F	76	36.59	-76.11	7.90
F	77	36.84	-75.24	6.43
F	78	36.84	-74.54	5.71
F	79	36.84	-73.85	4.98
F	80	36.84	-73.16	4.26
F	81	36.84	-72.47	3.54
F	82	36.84	-71.78	2.81
F	83	36.84	-71.09	2.09
F	84	36.84	-70.40	1.37
F	85	36.84	-69.71	0.65
F	86	36.84	-69.01	-0.08
F	87	36.84	-68.32	-0.80
F	88	36.84	-67.63	-1.52
F	89	36.84	-66.94	-2.24
F	90	36.84	-66.25	-2.97
F	91	36.84	-65.56	-3.69
F	92	36.84	-64.87	-4.41
F	93	36.84	-64.18	-5.13
F	94	36.84	-63.48	-5.86
F	95	36.84	-62.79	-6.58
F	96	36.84	-62.10	-7.30
F	97	36.84	-61.41	-8.02
F	98	36.84	-60.72	-8.75
F	99	36.84	-60.03	-9.47
F	100	36.84	-59.34	-10.19
F	101	36.84	-58.65	-10.91
F	102	36.84	-57.95	-11.64
F	103	36.84	-57.26	-12.36
F	104	36.84	-56.57	-13.08
F	105	36.84	-55.88	-13.81
F	106	36.84	-55.19	-14.53
F	107	36.84	-54.50	-15.25
F	108	36.84	-53.81	-15.97

F	109	36.84	-53.12	-16.70
F	110	36.84	-52.42	-17.42
F	111	36.84	-51.73	-18.14
F	112	36.84	-51.04	-18.86
F	113	36.84	-50.35	-19.59
F	114	36.84	-49.66	-20.31
F	115	36.59	-48.33	-21.34
F	116	36.59	-47.64	-22.06
F	117	36.59	-46.95	-22.78
F	118	36.59	-46.26	-23.50
F	119	36.59	-46.26	-36.81
F	120	36.59	-46.71	-35.92
F	121	36.59	-47.16	-35.03
F	122	36.59	-47.61	-34.13
F	123	36.59	-48.06	-33.24
F	124	36.59	-48.51	-32.35
F	125	36.59	-48.96	-31.45
F	126	36.59	-49.41	-30.56
F	127	36.59	-49.86	-29.67
F	128	36.59	-50.31	-28.78
F	129	36.59	-50.95	-28.00
F	130	36.59	-51.64	-27.27
F	131	36.59	-52.34	-26.55
F	132	36.59	-53.03	-25.83
F	133	36.84	-53.99	-24.46
F	134	36.84	-54.69	-23.73
F	135	36.84	-55.38	-23.01
F	136	36.84	-56.07	-22.29
F	137	36.84	-56.76	-21.57
F	138	36.84	-57.45	-20.84
F	139	36.84	-58.14	-20.12
F	140	36.84	-58.83	-19.40
F	141	36.84	-59.52	-18.68
F	142	36.84	-60.22	-17.95
F	143	36.84	-60.91	-17.23
F	144	36.84	-61.60	-16.51
F	145	36.84	-62.29	-15.79
F	146	36.84	-62.98	-15.06
F	147	36.84	-63.67	-14.34
F	148	36.84	-64.36	-13.62
F	149	36.84	-65.05	-12.89
F	150	36.84	-65.75	-12.17
F	151	36.84	-66.44	-11.45
F	152	36.84	-67.13	-10.73

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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F	153	36.84	-67.82	-10.00
F	154	36.84	-68.51	-9.28
F	155	36.84	-69.20	-8.56
F	156	36.84	-69.89	-7.84
F	157	36.84	-70.58	-7.11
F	158	36.84	-71.28	-6.39
F	159	36.84	-71.97	-5.67
F	160	36.84	-72.66	-4.95
F	161	36.84	-73.35	-4.22
F	162	36.84	-74.04	-3.50
F	163	36.84	-74.73	-2.78
F	164	36.84	-75.42	-2.06
F	165	36.84	-76.11	-1.33
F	166	36.84	-76.81	-0.61
F	167	36.84	-77.50	0.11
F	168	36.84	-78.19	0.83
F	169	36.84	-78.88	1.56
F	170	36.84	-79.57	2.28
F	171	36.59	-80.91	3.32
F	172	36.59	-81.60	4.04
F	173	36.59	-82.29	4.76
F	174	36.59	-82.98	5.48
F	175	36.59	-83.67	6.21
F	176	36.59	-84.36	6.93
F	177	36.59	-85.05	7.65
F	178	25.43	-28.66	-51.75
F	179	25.88	-29.11	-50.98
F	180	26.34	-29.56	-50.21
F	181	26.79	-30.02	-49.44
F	182	27.25	-30.47	-48.68
F	183	27.70	-30.93	-47.91
F	184	28.15	-31.38	-47.14
F	185	28.61	-31.83	-46.38
F	186	29.06	-32.29	-45.61
F	187	29.51	-32.74	-44.84
F	188	29.97	-33.19	-44.07
F	189	30.42	-33.65	-43.31
F	190	30.87	-34.10	-42.54
F	191	31.33	-34.55	-41.77
F	192	31.78	-35.01	-41.01
F	193	32.23	-35.46	-40.24
F	194	32.69	-35.91	-39.47
F	195	33.14	-36.37	-38.70
F	196	33.60	-36.82	-37.94

F	197	34.05	-37.28	-37.17
F	198	37.17	-40.39	-40.86
F	199	36.71	-39.94	-41.63
F	200	36.26	-39.49	-42.39
F	201	35.81	-39.03	-43.16
F	202	35.35	-38.58	-43.93
F	203	34.90	-38.13	-44.69
F	204	34.45	-37.67	-45.46
F	205	33.99	-37.22	-46.23
F	206	33.54	-36.77	-47.00
F	207	33.09	-36.31	-47.76
F	208	32.63	-35.86	-48.53
F	209	32.18	-35.40	-49.30
F	210	31.73	-34.95	-50.06
F	211	31.27	-34.50	-50.83
F	212	30.82	-34.04	-51.60
F	213	30.36	-33.59	-52.37
F	214	29.91	-33.14	-53.13
F	215	29.46	-32.68	-53.90
F	216	29.00	-32.23	-54.67
G	1	-36.52	-47.11	34.27
G	2	-36.52	-48.00	33.83
G	3	-36.52	-48.90	33.38
G	4	-36.52	-49.79	32.93
G	5	-36.52	-50.69	32.49
G	6	-36.52	-51.58	32.04
G	7	-36.52	-52.48	31.59
G	8	-36.52	-53.37	31.15
G	9	-36.52	-54.27	30.70
G	10	-36.52	-55.16	30.25
G	11	-36.52	-56.05	29.80
G	12	-36.52	-56.95	29.36
G	13	-36.84	-58.48	28.67
G	14	-36.84	-59.48	28.57
G	15	-36.84	-60.48	28.48
G	16	-36.84	-61.47	28.39
G	17	-36.84	-62.47	28.30
G	18	-36.84	-63.46	28.20
G	19	-36.84	-64.46	28.11
G	20	-36.84	-65.45	28.02
G	21	-36.84	-66.45	27.92
G	22	-36.84	-67.44	27.83
G	23	-36.84	-68.44	27.74
G	24	-36.84	-69.44	27.64

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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G	25	-36.84	-70.43	27.55
G	26	-36.84	-71.43	27.46
G	27	-36.84	-72.42	27.36
G	28	-36.52	-73.68	27.56
G	29	-36.52	-74.68	27.47
G	30	-36.52	-75.67	27.37
G	31	-36.52	-76.67	27.28
G	32	-36.52	-77.66	27.19
G	33	-36.52	-44.56	23.95
G	34	-36.52	-45.51	23.64
G	35	-36.52	-46.46	23.34
G	36	-36.52	-47.41	23.04
G	37	-36.52	-48.37	22.73
G	38	-36.52	-49.32	22.43
G	39	-36.52	-50.27	22.13
G	40	-36.52	-51.23	21.82
G	41	-36.52	-52.21	21.68
G	42	-36.52	-53.21	21.58
G	43	-36.52	-54.20	21.49
G	44	-36.52	-55.20	21.40
G	45	-36.52	-56.20	21.30
G	46	-36.84	-57.81	21.45
G	47	-36.84	-58.80	21.36
G	48	-36.84	-59.80	21.26
G	49	-36.84	-60.80	21.17
G	50	-36.84	-61.79	21.08
G	51	-36.84	-62.79	20.98
G	52	-36.84	-63.78	20.89
G	53	-36.84	-64.78	20.80
G	54	-36.84	-65.77	20.70
G	55	-36.84	-66.77	20.61
G	56	-36.84	-67.76	20.52
G	57	-36.84	-68.76	20.42
G	58	-36.84	-69.76	20.33
G	59	-36.84	-70.75	20.24
G	60	-36.84	-71.75	20.14
G	61	-36.52	-72.95	19.72
G	62	-36.52	-73.94	19.63
G	63	-36.52	-74.94	19.53
G	64	-36.52	-75.93	19.44
G	65	-36.52	-76.93	19.35
G	66	-36.09	-78.70	18.33
G	67	-36.09	-78.70	17.33
G	68	-36.09	-78.70	16.33

G	69	-36.09	-78.70	15.33
G	70	-36.09	-78.70	14.33
G	71	-36.09	-78.70	13.33
G	72	-36.59	-78.88	10.79
G	73	-36.59	-78.19	10.07
G	74	-36.59	-77.50	9.35
G	75	-36.59	-76.80	8.62
G	76	-36.59	-76.11	7.90
G	77	-36.84	-75.24	6.43
G	78	-36.84	-74.54	5.71
G	79	-36.84	-73.85	4.98
G	80	-36.84	-73.16	4.26
G	81	-36.84	-72.47	3.54
G	82	-36.84	-71.78	2.81
G	83	-36.84	-71.09	2.09
G	84	-36.84	-70.40	1.37
G	85	-36.84	-69.71	0.65
G	86	-36.84	-69.01	-0.08
G	87	-36.84	-68.32	-0.80
G	88	-36.84	-67.63	-1.52
G	89	-36.84	-66.94	-2.24
G	90	-36.84	-66.25	-2.97
G	91	-36.84	-65.56	-3.69
G	92	-36.84	-64.87	-4.41
G	93	-36.84	-64.18	-5.13
G	94	-36.84	-63.48	-5.86
G	95	-36.84	-62.79	-6.58
G	96	-36.84	-62.10	-7.30
G	97	-36.84	-61.41	-8.02
G	98	-36.84	-60.72	-8.75
G	99	-36.84	-60.03	-9.47
G	100	-36.84	-59.34	-10.19
G	101	-36.84	-58.65	-10.91
G	102	-36.84	-57.95	-11.64
G	103	-36.84	-57.26	-12.36
G	104	-36.84	-56.57	-13.08
G	105	-36.84	-55.88	-13.81
G	106	-36.84	-55.19	-14.53
G	107	-36.84	-54.50	-15.25
G	108	-36.84	-53.81	-15.97
G	109	-36.84	-53.12	-16.70
G	110	-36.84	-52.42	-17.42
G	111	-36.84	-51.73	-18.14
G	112	-36.84	-51.04	-18.86

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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G	113	-36.84	-50.35	-19.59
G	114	-36.84	-49.66	-20.31
G	115	-36.59	-48.33	-21.34
G	116	-36.59	-47.64	-22.06
G	117	-36.59	-46.95	-22.78
G	118	-36.59	-46.26	-23.50
G	119	-36.59	-46.26	-36.81
G	120	-36.59	-46.71	-35.92
G	121	-36.59	-47.16	-35.03
G	122	-36.59	-47.61	-34.13
G	123	-36.59	-48.06	-33.24
G	124	-36.59	-48.51	-32.35
G	125	-36.59	-48.96	-31.45
G	126	-36.59	-49.41	-30.56
G	127	-36.59	-49.86	-29.67
G	128	-36.59	-50.31	-28.78
G	129	-36.59	-50.95	-28.00
G	130	-36.59	-51.64	-27.27
G	131	-36.59	-52.34	-26.55
G	132	-36.59	-53.03	-25.83
G	133	-36.84	-53.99	-24.46
G	134	-36.84	-54.69	-23.73
G	135	-36.84	-55.38	-23.01
G	136	-36.84	-56.07	-22.29
G	137	-36.84	-56.76	-21.57
G	138	-36.84	-57.45	-20.84
G	139	-36.84	-58.14	-20.12
G	140	-36.84	-58.83	-19.40
G	141	-36.84	-59.52	-18.68
G	142	-36.84	-60.22	-17.95
G	143	-36.84	-60.91	-17.23
G	144	-36.84	-61.60	-16.51
G	145	-36.84	-62.29	-15.79
G	146	-36.84	-62.98	-15.06
G	147	-36.84	-63.67	-14.34
G	148	-36.84	-64.36	-13.62
G	149	-36.84	-65.05	-12.89
G	150	-36.84	-65.75	-12.17
G	151	-36.84	-66.44	-11.45
G	152	-36.84	-67.13	-10.73
G	153	-36.84	-67.82	-10.00
G	154	-36.84	-68.51	-9.28
G	155	-36.84	-69.20	-8.56
G	156	-36.84	-69.89	-7.84

G	157	-36.84	-70.58	-7.11
G	158	-36.84	-71.28	-6.39
G	159	-36.84	-71.97	-5.67
G	160	-36.84	-72.66	-4.95
G	161	-36.84	-73.35	-4.22
G	162	-36.84	-74.04	-3.50
G	163	-36.84	-74.73	-2.78
G	164	-36.84	-75.42	-2.06
G	165	-36.84	-76.11	-1.33
G	166	-36.84	-76.81	-0.61
G	167	-36.84	-77.50	0.11
G	168	-36.84	-78.19	0.83
G	169	-36.84	-78.88	1.56
G	170	-36.84	-79.57	2.28
G	171	-36.59	-80.91	3.32
G	172	-36.59	-81.60	4.04
G	173	-36.59	-82.29	4.76
G	174	-36.59	-82.98	5.48
G	175	-36.59	-83.67	6.21
G	176	-36.59	-84.36	6.93
G	177	-36.59	-85.05	7.65
G	178	-25.43	-28.66	-51.75
G	180	-25.88	-29.11	-50.98
G	180	-26.34	-29.56	-50.21
G	181	-26.79	-30.02	-49.44
G	182	-27.25	-30.47	-48.68
G	183	-27.70	-30.93	-47.91
G	184	-28.15	-31.38	-47.14
G	185	-28.61	-31.83	-46.38
G	186	-29.06	-32.29	-45.61
G	187	-29.51	-32.74	-44.84
G	189	-29.97	-33.19	-44.07
G	189	-30.42	-33.65	-43.31
G	190	-30.87	-34.10	-42.54
G	191	-31.33	-34.55	-41.77
G	192	-31.78	-35.01	-41.01
G	193	-32.23	-35.46	-40.24
G	194	-32.69	-35.91	-39.47
G	195	-33.14	-36.37	-38.70
G	196	-33.60	-36.82	-37.94
G	197	-34.05	-37.28	-37.17
G	198	-37.17	-40.39	-40.86
G	199	-36.71	-39.94	-41.63
G	200	-36.26	-39.49	-42.39

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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G	201	-35.81	-39.03	-43.16
G	202	-35.35	-38.58	-43.93
G	203	-34.90	-38.13	-44.69
G	204	-34.45	-37.67	-45.46
G	205	-33.99	-37.22	-46.23
G	206	-33.54	-36.77	-47.00
G	207	-33.09	-36.31	-47.76
G	208	-32.63	-35.86	-48.53
G	209	-32.18	-35.40	-49.30
G	210	-31.73	-34.95	-50.06
G	211	-31.27	-34.50	-50.83
G	212	-30.82	-34.04	-51.60
G	213	-30.36	-33.59	-52.37
G	214	-29.91	-33.14	-53.13
G	215	-29.46	-32.68	-53.90
G	216	-29.00	-32.23	-54.67
H	1	-42.15	-47.11	34.27
H	2	-42.15	-48.00	33.83
H	3	-42.15	-48.90	33.38
H	4	-42.15	-49.79	32.93
H	5	-42.15	-50.69	32.49
H	6	-42.15	-51.58	32.04
H	7	-42.15	-52.48	31.59
H	8	-42.15	-53.37	31.15
H	9	-42.15	-54.27	30.70
H	10	-42.15	-55.16	30.25
H	11	-42.15	-56.05	29.80
H	12	-42.15	-56.95	29.36
H	13	-41.84	-58.48	28.67
H	14	-41.84	-59.48	28.57
H	15	-41.84	-60.48	28.48
H	16	-41.84	-61.47	28.39
H	17	-41.84	-62.47	28.30
H	18	-41.84	-63.46	28.20
H	19	-41.84	-64.46	28.11
H	20	-41.84	-65.45	28.02
H	21	-41.84	-66.45	27.92
H	22	-41.84	-67.44	27.83
H	23	-41.84	-68.44	27.74
H	24	-41.84	-69.44	27.64
H	25	-41.84	-70.43	27.55
H	26	-41.84	-71.43	27.46
H	27	-41.84	-72.42	27.36
H	28	-42.15	-73.68	27.56

H	29	-42.15	-74.68	27.47
H	30	-42.15	-75.67	27.37
H	31	-42.15	-76.67	27.28
H	32	-42.15	-77.66	27.19
H	33	-42.15	-44.56	23.95
H	34	-42.15	-45.51	23.64
H	35	-42.15	-46.46	23.34
H	36	-42.15	-47.41	23.04
H	37	-42.15	-48.37	22.73
H	38	-42.15	-49.32	22.43
H	39	-42.15	-50.27	22.13
H	40	-42.15	-51.23	21.82
H	41	-42.15	-52.21	21.68
H	42	-42.15	-53.21	21.58
H	43	-42.15	-54.20	21.49
H	44	-42.15	-55.20	21.40
H	45	-42.15	-56.20	21.30
H	46	-41.84	-57.81	21.45
H	47	-41.84	-58.80	21.36
H	48	-41.84	-59.80	21.26
H	49	-41.84	-60.80	21.17
H	50	-41.84	-61.79	21.08
H	51	-41.84	-62.79	20.98
H	52	-41.84	-63.78	20.89
H	53	-41.84	-64.78	20.80
H	54	-41.84	-65.77	20.70
H	55	-41.84	-66.77	20.61
H	56	-41.84	-67.76	20.52
H	57	-41.84	-68.76	20.42
H	58	-41.84	-69.76	20.33
H	59	-41.84	-70.75	20.24
H	60	-41.84	-71.75	20.14
H	61	-42.15	-72.95	19.72
H	62	-42.15	-73.94	19.63
H	63	-42.15	-74.94	19.53
H	64	-42.15	-75.93	19.44
H	65	-42.15	-76.93	19.35
H	66	-42.59	-78.70	18.33
H	67	-42.59	-78.70	17.33
H	68	-42.59	-78.70	16.33
H	69	-42.59	-78.70	15.33
H	70	-42.59	-78.70	14.33
H	71	-42.59	-78.70	13.33
H	72	-42.09	-78.88	10.79

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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H	73	-42.09	-78.19	10.07
H	74	-42.09	-77.50	9.35
H	75	-42.09	-76.80	8.62
H	76	-42.09	-76.11	7.90
H	77	-41.84	-75.24	6.43
H	78	-41.84	-74.54	5.71
H	79	-41.84	-73.85	4.98
H	80	-41.84	-73.16	4.26
H	81	-41.84	-72.47	3.54
H	82	-41.84	-71.78	2.81
H	83	-41.84	-71.09	2.09
H	84	-41.84	-70.40	1.37
H	85	-41.84	-69.71	0.65
H	86	-41.84	-69.01	-0.08
H	87	-41.84	-68.32	-0.80
H	88	-41.84	-67.63	-1.52
H	89	-41.84	-66.94	-2.24
H	90	-41.84	-66.25	-2.97
H	91	-41.84	-65.56	-3.69
H	92	-41.84	-64.87	-4.41
H	93	-41.84	-64.18	-5.13
H	94	-41.84	-63.48	-5.86
H	95	-41.84	-62.79	-6.58
H	96	-41.84	-62.10	-7.30
H	97	-41.84	-61.41	-8.02
H	98	-41.84	-60.72	-8.75
H	99	-41.84	-60.03	-9.47
H	100	-41.84	-59.34	-10.19
H	101	-41.84	-58.65	-10.91
H	102	-41.84	-57.95	-11.64
H	103	-41.84	-57.26	-12.36
H	104	-41.84	-56.57	-13.08
H	105	-41.84	-55.88	-13.81
H	106	-41.84	-55.19	-14.53
H	107	-41.84	-54.50	-15.25
H	108	-41.84	-53.81	-15.97
H	109	-41.84	-53.12	-16.70
H	110	-41.84	-52.42	-17.42
H	111	-41.84	-51.73	-18.14
H	112	-41.84	-51.04	-18.86
H	113	-41.84	-50.35	-19.59
H	114	-41.84	-49.66	-20.31
H	115	-42.09	-48.33	-21.34
H	116	-42.09	-47.64	-22.06

H	117	-42.09	-46.95	-22.78
H	118	-42.09	-46.26	-23.50
H	119	-42.09	-46.26	-36.81
H	120	-42.09	-46.71	-35.92
H	121	-42.09	-47.16	-35.03
H	123	-42.09	-47.61	-34.13
H	124	-42.09	-48.06	-33.24
H	124	-42.09	-48.51	-32.35
H	125	-42.09	-48.96	-31.45
H	126	-42.09	-49.41	-30.56
H	127	-42.09	-49.86	-29.67
H	128	-42.09	-50.31	-28.78
H	129	-42.09	-50.95	-28.00
H	130	-42.09	-51.64	-27.27
H	131	-42.09	-52.34	-26.55
H	132	-42.09	-53.03	-25.83
H	133	-41.84	-53.99	-24.46
H	134	-41.84	-54.69	-23.73
H	135	-41.84	-55.38	-23.01
H	136	-41.84	-56.07	-22.29
H	137	-41.84	-56.76	-21.57
H	138	-41.84	-57.45	-20.84
H	139	-41.84	-58.14	-20.12
H	140	-41.84	-58.83	-19.40
H	141	-41.84	-59.52	-18.68
H	142	-41.84	-60.22	-17.95
H	143	-41.84	-60.91	-17.23
H	144	-41.84	-61.60	-16.51
H	145	-41.84	-62.29	-15.79
H	146	-41.84	-62.98	-15.06
H	147	-41.84	-63.67	-14.34
H	148	-41.84	-64.36	-13.62
H	149	-41.84	-65.05	-12.89
H	150	-41.84	-65.75	-12.17
H	151	-41.84	-66.44	-11.45
H	152	-41.84	-67.13	-10.73
H	153	-41.84	-67.82	-10.00
H	154	-41.84	-68.51	-9.28
H	155	-41.84	-69.20	-8.56
H	156	-41.84	-69.89	-7.84
H	157	-41.84	-70.58	-7.11
H	158	-41.84	-71.28	-6.39
H	159	-41.84	-71.97	-5.67
H	160	-41.84	-72.66	-4.95

ID	#	X (AMS)	Y (AMS)	Z (AMS)		ID	#	X (AMS)	Y (AMS)	Z (AMS)
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H	161	-41.84	-73.35	-4.22
H	162	-41.84	-74.04	-3.50
H	163	-41.84	-74.73	-2.78
H	164	-41.84	-75.42	-2.06
H	165	-41.84	-76.11	-1.33
H	166	-41.84	-76.81	-0.61
H	167	-41.84	-77.50	0.11
H	168	-41.84	-78.19	0.83
H	169	-41.84	-78.88	1.56
H	170	-41.84	-79.57	2.28
H	171	-42.09	-80.91	3.32
H	172	-42.09	-81.60	4.04
H	173	-42.09	-82.29	4.76
H	174	-42.09	-82.98	5.48
H	175	-42.09	-83.67	6.21
H	176	-42.09	-84.36	6.93
H	177	-42.09	-85.05	7.65
H	178	-28.66	-25.43	-51.75
H	179	-29.11	-25.88	-50.98
H	180	-29.56	-26.34	-50.21
H	181	-30.02	-26.79	-49.44
H	182	-30.47	-27.25	-48.68
H	183	-30.93	-27.70	-47.91
H	184	-31.38	-28.15	-47.14
H	185	-31.83	-28.61	-46.38
H	186	-32.29	-29.06	-45.61
H	187	-32.74	-29.51	-44.84
H	188	-33.19	-29.97	-44.07
H	189	-33.65	-30.42	-43.31
H	190	-34.10	-30.87	-42.54
H	191	-34.55	-31.33	-41.77
H	192	-35.01	-31.78	-41.01
H	193	-35.46	-32.23	-40.24
H	194	-35.91	-32.69	-39.47
H	195	-36.37	-33.14	-38.70
H	196	-36.82	-33.60	-37.94
H	197	-37.28	-34.05	-37.17
H	198	-40.39	-37.17	-40.86
H	199	-39.94	-36.71	-41.63
H	200	-39.49	-36.26	-42.39
H	201	-39.03	-35.81	-43.16
H	202	-38.58	-35.35	-43.93
H	203	-38.13	-34.90	-44.69
H	204	-37.67	-34.45	-45.46

H	205	-37.22	-33.99	-46.23
H	206	-36.77	-33.54	-47.00
H	207	-36.31	-33.09	-47.76
H	208	-35.86	-32.63	-48.53
H	209	-35.40	-32.18	-49.30
H	210	-34.95	-31.73	-50.06
H	211	-34.50	-31.27	-50.83
H	212	-34.04	-30.82	-51.60
H	213	-33.59	-30.36	-52.37
H	214	-33.14	-29.91	-53.13
H	215	-32.68	-29.46	-53.90
H	216	-32.23	-29.00	-54.67

